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OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1832.

Remarks upon the recent patent for a Shot, and Shell, with Spiral Flanches.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The October number of your Journal contains an account of the specification of a patent, granted to William B. Pier and Andrew Mark, of Detroit, Michigan Territory, "for an improvement in the science of gunnery, which may be used as a substitute for the ordinary bomb shell, or howitzer, &c." It can, I think, be shown that the patentees have been anticipated in the principles of their invention, and that various defects to which, in practice, their plan would be liable, have been avoided in the prior invention to which I allude. If these facts are so, while one must regret the expenditure of ingenuity, of time, and, perhaps, of money, already encountered by the patentees, it can but be a service to them to prevent their more serious loss of each, which, probably, will be consequent on endeavours to bring the scheme into use, under the sanction of a patent right which cannot be sustained.

It is well known that a canon ball, whatever pains may have been taken in its casting, is, as a general rule, not of uniform density throughout; as a consequence of this, if a ball were supposed to leave the muzzle of a gun without having acquired a rotary motion, the forces which act upon it in its flight would produce such a motion. This is especially the case with hollow shot, or shells, the construction and loading of which effectually prevent the coinciding of the centre of gravity with the centre of the shell. These projectiles are placed in the mortar, from which they are thrown, with the fusee towards the muzzle; immediately on leaving the muzzle the fusee is seen turn-

ed in the opposite direction, and a rotation which may be very distinctly traced in night firing, is commenced about a line inclined to the axis of the mortar. This rotation produces not only a deviation in the shell, or shot, in the vertical plane passing through the axis of the piece, but also from that plane. In small arms, the defects just stated are remedied by grooving the barrel, as in the rifle. By these grooves a tendency to rotation is produced in the ball while passing through the barrel; a rotation which the action of the air, upon the grooves produced in the ball, tends to keep up. The axis of rotation coincides with that of the barrel, and there is no tendency produced to vary the curve in the plane of projection, nor to depart from that plane; under these circumstances the aim becomes certain.

We may suppose the patentees to have reasoned upon some such principles in their endeavour to give to larger projectiles the accuracy of flight of the rifle ball. They propose to effect this by using spiral flanches upon their shells, or shot, by which to give a rotation similar to that produced in the rifle. The form of the shot, independently of the flanches, "is that of an elongated egg with the small end truncated, or cut square off." "The large, or forward end, which nearly fits the calibre of the piece, is a solid hemisphere of metal, the weight of which will insure its keeping the proper direction when fired from the piece." This form is admirably calculated to defeat the object to be accomplished by the flanches, and would seem to show that I have attributed too much practical knowledge of the motion of projectiles to the patentees. It is certain that the solid hemisphere in front, instead of increasing the accuracy of the fire, would, by a tendency to descend, at the instant of leaving the piece, begin a rotation about an axis perpendicular to the axis of the piece, the effect of which on the rotation to be produced by the flanches, parallel to that axis, is obvious.

The shell now patented is "to be made to explode by means of percussion powder. For this purpose a hole is to be drilled through the larger end, or bulb, of the shell, in the direction of the axis." "An iron or steel bolt surrounded by leather, or other elastic substance, is put over the percussion powder, and extends out from the front of the shell; its exterior end widens out like a nail or bolt head. This striking against any hard substance, occasions the contents of the shell to explode."

I shall show that the patentees have been anticipated in their design of using spiral flanches, and, also, in their project for making a shell to explode when it strikes; unless, indeed, in relation to the latter point, the use of a conical plug of iron, covered with leather, instead of a wooden cylinder, be, *technically*, of importance. With regard to the form of the shell, if my remarks be correct, it is very defective.

To prove the positions taken, I shall give extracts from a "Description of a Percussion shell,* to be fired horizontally from a common gun. By Lieutenant Colonel Miller, late of the Rifle Bri-

* Transactions of the Royal Society of London, Part I, 1827.

gade," &c. This paper was published in 1827, and purports to have been read before the Royal Society of London, on the 16th and 23d of November, 1826.

After giving an outline of the theory of the rifle, Col. Miller details experiments, by which he proved that a rotary motion about the longer axis of a projectile might be given to it by grooving the projectile itself. The cylindrical form was first tried, and subsequently an attempt made to terminate the cylinder by a hemisphere, which failed. The conclusions drawn from the experiments are thus stated.

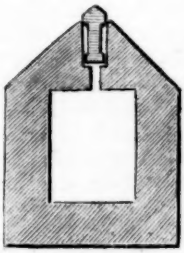
"Having, as I conceived, conclusively ascertained by experiment, that the spiral motion might be communicated to a grooved cylindrical ball fired from a plain barrel, it occurred to me that by the help of this principle, shells might be so constructed as to explode by percussion. The plan I have adopted for this purpose will be easily understood by an examination of the annexed figure.* A round peg is placed in the apex of the cone, working in a cylinder, and a pellet of percussion powder is placed under the peg, and over the vent which communicates with the cavity of the shell. By this means, as soon as the point of the peg strikes against any hard substance, it slides in, and ignites the percussion powder, which instantly communicates with the bursting charge."

An account of experiments with these shells in different situations, with various charges, and fired at different objects, is next given: two series of these experiments were made in 1823, and a third in 1826. From these the following conclusions are drawn.

"So far as range and efficiency are concerned, the experiments have perhaps been as successful as could have been expected, in so novel an invention. With respect to accuracy of fire, I am fully sensible that much still remains to be done; and to those who ask why this most important object was not more completely attained before the discovery was submitted to the public, I beg leave to answer, that no invention in gunnery, so far as I am aware, either in former or more recent times, has ever been brought to perfection without the help of long continued and laborious experiments, which from their nature are so expensive that they cannot be expected to be prosecuted at the cost of any individual. In the present instance, only one hundred and four shells have been fired altogether, eighty-five of which were filled with powder, and, out of these, thirty-nine exploded upon striking the objects fired at. In the experiments made at Woolwich, on the Pheasant, sloop of war, in the river, which are certainly the most important that have yet been made, only eleven succeeded out of thirty-one; no great number certainly, but at the same time enough to have destroyed the vessel had they been heavy metal. The fire at present is sufficiently accurate for the range at which naval actions are generally fought, but the object in view is to make them available to the full extent of their range, and I shall accordingly point out the means by which I conceive this object may

* See the cut on p. 364.

be very much facilitated. Considerable improvement may, I think, yet be made in the mode of casting them; for although the gentlemen of the Carron Company have bestowed great pains on those that were cast by them, it seldom happens, in matters of this kind, that the most simple process is discovered in the first instance. They may also be turned in a lathe by means of machinery, which their shape will allow them to be with great facility, and thus rendered perfectly cylindrical, and of the same size. In the course of the experiments that have been made, the shell has also been greatly improved by an addition to the length originally given to it. This might, a priori, have been expected, as its weight is increased without increasing the resistance of the air; and by this alteration its range is found to be increased also. The accuracy of fire is also found to be greater, as the angle of departure is diminished. Hence, greater accuracy of fire may be expected from heavy guns than from light ones, the sides of the shells in the former being much longer than in the latter, while the windage in both is equal. The following construction of a shell for a nine pounder, I consider as the best, so far as the experiments made will allow me to determine. In these proportions the length of the sides is increased half an inch beyond that of any yet used, and the twist is reduced from fifty-five to seventy-two inches.



Length,	6.24	inches.
Diameter,	4.16	,,
Length of sides,	4.16	,,
Height of cone,	2.08	,,
Depth of grooves,	0.20	,,
Width of ditto round the circumference,	0.80	,,
Length of peg,	1.40	,,
Diameter of ditto,	0.40	,,
Diameter of vent,	0.15	,,
Thickness of sides,	0.85	,,
Thickness of bottom,	0.74	,,
Diameter of chamber,	2.46	,,
Height of ditto,	3.42	,,
Windage,	0.04	,,

The necessity of *perfectly* balancing the shell is insisted on, and a method of effecting it is given in the paragraph which follows.

"In all the experiments already made, it has been observed that the line of fire is generally good, but that the shells which have missed the object, went almost invariably either too high or too low, which is exactly the result we might, from theory, expect, when their ends are not perfectly balanced. The method of proving whether their ends be exactly balanced, is by floating them in mercury, their specific gravity when filled being something less than half that of mercury. When properly balanced, they float horizontally, and the balance is not perfect until that is effected."

The successful experiments of the Messrs. Stevens, of New York, with shells exploding on striking an object, were prior to those of Col. Miller; the details of them, and the method of accomplishing

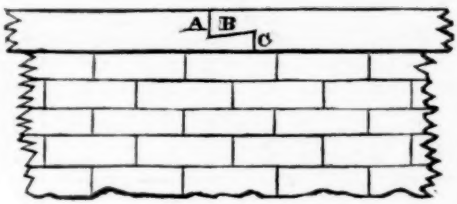
their object, were, I believe, never made public. The form of the shell differed from that of Col. Miller, as well as that of the recent patentees.

B.

Expansion and Contraction of Coping Stones.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—Observing in your number for July, 1832, that the contraction and expansion of coping stones had been attended with unpleasant consequences in the opening of the joints, I take the liberty of handing you the annexed sketch for the joints of coping stones, which has been found sufficient to protect the wall from the drip at the joints. If the joints are made as in the sketch the water can never injure the wall through them.



It is necessary that the water should pass through the joints A, B, C, to get to the wall, but this is effectually prevented by the inclination of the joint B. It is more expensive than the common method, but needs no cement, and the ordinary contractions and expansions can never injure it.

I am, sir, respectfully,

Your obedient servant,

W. T.

FRANKLIN INSTITUTE.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a moving Power.

[Continued from p. 302.]

TABLE 3.—PART I.

WHEEL No. IV.—30 *Oblique buckets. Close breast. Water let on at upper centre of wheel.*

No. of Expert.	Head of water above. Bun. of gate.	Head of water above. Top of bkt.	Head of water above. Bun. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Seds.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	1.00	57	23.07	80.07	40.0	38½	5.64	625	6.50	40625	32028	.788			
2					71	23.20	94.20		42	5.16	730		47450	37680	.794			
3					85	23.33	108.33		47½	4.57	825		53625	43332	.808	.808	4.57	
4					99	23.46	122.46		57½	3.77	955		62075	48984	.789			
5				1.25	71	23.20	94.20		37½	5.77	750		48750	37680	.773			
6					85	23.33	108.33		47½	4.57	855		55575	43332	.779			
7					99	23.46	122.46		50	4.34	965		62725	48984	.781	.781	4.34	
8					113	23.59	136.59		55½	3.90	1085		70525	54636	.775			
9				1.50	85	23.33	108.33		38½	5.64	880		57200	43332	.757			
10					99	23.46	122.46		41½	5.22	990		64350	48984	.761			
11					113	23.59	136.59		48½	4.47	1085		70525	54636	.775			
12					127	23.72	150.72		54	4.01	1190		77350	60288	.779			
13					138	23.82	161.82		54½	3.97	1240		80600	64728	.803	.803	3.97	
14					146	23.90	169.90		59	3.67	1315		85475	67960	.795			
15				1.75	132	23.77	155.77		47½	4.57	1295		84175	62308	.740			
16					146	23.90	169.90		49½	4.38	1385		90025	67960	.755			
17					160	24.03	184.03		55½	3.90	1490		96850	73612	.760			
18					174	24.16	198.16		57	3.81	1580		102700	79264	.772	.772	3.81	
19					202	24.42	226.42		61½	3.52	1830		118950	90568	.762			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

TABLE 3.—PART II

WHEEL No. IV.—30 *Oblique buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exp'l.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bk t.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W'tofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.25	0.50	1.00	2.00	132	23.77	155.77	40.0	44	4.90	1355	6.50	88075	62308	.707			
21					160	24.03	184.03		49½	4.38	1560		101400	73612	.726			
22					174	24.16	198.16		54	4.01	1660		107900	79264	.734			
23					202	24.42	226.42		59½	3.64	1870		121550	90568	.745	.745	3.64	
24	0.75	1.00	1.50	0.75	113	23.59	136.59	40.0	33½	6.47	1050	7.00	73500	54636	.743			
25					132	23.77	155.77		37	5.86	1195		83650	62308	.745			
26					146	23.90	169.90		41½	5.22	1305		91350	67960	.744			
27					160	24.03	184.03		43	5.03	1405		98350	73612	.748			
28					174	24.16	198.16		46½	4.67	1505		105350	79264	.753			
29					188	24.29	212.29		66½	3.25	1575		110250	84916	.770	.770	3.25	
30					216	24.55	240.55		79½	2.73	1825		127750	96220	.754			
31					230	24.68	254.68		59	3.67	1930		135100	101872	.754			
32					235	24.73	259.73		60½	3.58	2000		140000	103892	.742			
33				1.00	132	23.77	155.77		32½	6.67	1205		84350	62308	.739			
34					216	24.55	240.55		73	2.97	1770		123900	96220	.777	.777	2.97	
35					230	24.68	255.68		62½	3.47	1885		131950	101872	.772			
36					249	24.86	273.86		71	3.06	2070		144900	109544	.756			
37					263	24.99	287.99		58	3.74	2170		151900	115196	.758			
38					277	25.12	302.12		62	3.50	2325		162750	120848	.742			
39					291	25.25	316.25		63½	3.41	2445		171150	126500	.739			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table 3.—Part III.

Wheel No. IV.—30 *Oblique buckets. Close Breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	0.75	1.00	1.50	1.25	305	25.38	330.38	40.0	56½	3.83	2500	7.00	175000	132152	.755			
41					319	25.51	344.51		60	3.61	2580		180600	137804	.763	.763	3.61	
42					333	25.64	358.64		61	3.55	2715		190050	143456	.755			
43				1.75	352	25.82	377.82		59½	3.64	3055		213850	151128	.707			
44					366	25.95	391.95		61	3.55	3135		219450	156780	.715	.715	3.55	
45					380	26.08	406.08		63	3.44	3250		227500	162432	.714			
46					394	26.21	420.21		64½	3.36	3375		236250	168084	.712			
47					408	26.34	434.34		68	3.19	3530		247100	173736	.703			
48	1.75	2.00	2.50	0.75	291	25.25	316.25	40.0	59	3.67	2250	8.00	180000	126500	.703	.703	3.67	
49					319	25.51	344.51		64½	3.36	2500		200000	137804	.689			
50					333	25.64	358.64		66	3.28	2600		208000	143456	.690			
51				1.00	338	25.69	363.69		48½	4.47	2625		210000	145476	.693			
52					352	25.82	377.82		46½	4.67	2700		216000	151128	.700	.700	4.67	
53					366	25.95	391.95		50½	4.32	2805		224400	156780	.699			
54					380	26.08	406.08		59	3.67	2920		233600	162432	.695			
55					394	26.21	420.21		63½	3.41	3040		243200	168084	.691			
56					408	26.34	434.34		69½	3.12	3200		256000	173736	.679			
57	2.75	3.00	3.50	1.50	319	25.51	344.51	40.0	38	5.71	2380	9.00	214200	137804	.643			
58					333	25.64	358.64		40	5.42	2475		222750	143456	.644	.644	5.42	
59					352	25.82	377.82		42½	5.10	2630		236700	151128	.638			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table 4.

Wheel No. IV.—30 *Curved buckets.* *Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio. power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Secs.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	0.50	113	23.59	136.59	40.0	37½	5.78	1080	6.50	75600	54636	.723			
2					127	23.72	150.72		40½	5.35	1185		82950	60288	.727	.727	5.35	
3					146	23.90	169.90		47	4.61	1360		95200	67960	.714			
4				1.00	85	23.33	108.33		44	4.90	850		55250	43332	.784			
5					99	23.46	122.46		52½	4.13	940		61100	48984	.802	.802	4.13	
6					127	23.72	150.72		63	3.44	1180		76700	60288	.786			
7					146	23.90	169.90		73½	2.95	1355		88075	67960	.772			
8				1.25	113	23.59	136.59		49	4.43	1105		71825	54636	.761			
9					132	23.77	155.77		57½	3.77	1255		81575	62308	.764			
10					146	23.90	169.90		60	3.61	1360		88400	67960	.769	.769	3.61	
11	1.75	2.00	2.50	0.25	132	23.77	155.77	40.0	52	4.17	1170	8.00	93600	62308	.666			
12					146	23.90	169.90		55½	3.90	1270		101600	67960	.669			
13					160	24.03	184.03		55½	3.90	1360		108800	73612	.677	.677	3.90	
14					174	24.16	198.16		50½	4.29	1475		118000	79264	.672			
15					188	24.29	212.29		65	3.34	1625		130000	84916	.653			
16				0.50	160	24.03	184.03		37½	5.78	1460		116800	73612	.630			
17					174	24.16	198.16		52	4.17	1460		116800	79264	.679	.679	4.17	
18					188	24.29	212.29		43	5.03	1620		129600	84916	.655			
19					216	24.55	240.55		47½	4.57	1905		152400	96220	.631			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 5.—PART I.

WHEEL No. IV.—30 *Curved buckets of fig. 5, Plate VIII. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	0,42		1.17	2.25	146	23.90	169.90	40.0	47½	4.57	1380	6,67	92046	67960	.738			
2					160	24.03	184.03		52	4.17	1455		97048	73612	.758			
3					174	24.16	198.16		53	4.09	1570		104719	79264	.757			
4					188	24.29	212.29		57½	3.76	1675		111722	84916	.760			
5					202	24.42	226.42		63½	3.42	1800		120060	90568	.755			
6					216	24.55	240.55		64½	3.36	1820		121394	96220	.793			
7					230	24.68	254.68		68	3.19	2030		135401	101872	.752			
8					235	24.73	259.73		78	2.78	2100		140070	103892	.742			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 5.—PART II.

WHEEL No. IV.—30 *Curved buckets of fig. 5, Plate VIII. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Bttm. of gate.	Head of water above. Top of bkt.	Head of water above. Bttm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75		0.84		85	23.33	108.33	40.0	47	4.63	1480	6.67	98716	43332	.439			Water run over the gate 2¾
2					113	23.59	136.59		55	3.93	1515		101050	54636	.541			inches deep, when drawn
3					127	23.72	150.72		58	3.74	1645		109722	60288	.550			entirely open with 6 ft. 8
4					146	23.90	169.90		65	3.34	1790		119393	67960	.569			inches head and fall—wheel
5					160	24.03	184.03		64	3.39	1870		124729	73612	.590			removed one inch from
6					174	24.16	198.16		68	3.19	1975		131399	79264	.603			breast—tail-way one-eighth
7					188	24.29	212.29		71	3.06	2100		140070	84916	.606			in. from bottom of wheel.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

Quarterly Meeting.

The thirty-fifth quarterly meeting of the Institute was held at their Hall, October 18, 1832.

Alexander Ferguson was appointed Chairman, and

Frederick Fraley, Recording Secretary, P. T.

The minutes of the thirty-third quarterly meeting were read and approved.

The thirty-fifth quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on Publications, with instruction to publish it in the Journal of the Institute.

The quarterly report of the Treasurer was read and accepted.

On motion, the reading of the thirty-fourth quarterly report of the Board of Managers was called for, as a quorum sufficient to transact business did not attend on the evening appointed for that meeting, and the report was not read; after reading the report it was accepted and referred to the committee on publications for insertion in the Journal of the Institute.

Professor A. D. Bache made some remarks on the art of medal ruling, in which he claimed the credit of the present useful application of it for America: he submitted specimens of the work executed by Asa Spencer, of Philadelphia, to the meeting, and the first published specimen of the execution of Mr. Bate, of London, contained in Prof. Babbage's work on the economy of manufactures and machinery. He drew a comparison between the works, favourable to that of Mr. Spencer, remarking that the distortion produced by the method used by this artist, although it would become perceptible in works of very high relief, was scarcely so in medal ruling, and did not turn the balance in favour of the work of Mr. Bate of which the specimen was exhibited.

A copy of the diploma of membership of the Institute, just finished, was laid on the table for the inspection of the members.

Extract from the minutes.

Alexr. Ferguson, *Chairman.*

Frederick Fraley, *Rec. Sec. P. T.*

Thirty-fourth Quarterly Report of the Board of Managers of the Franklin Institute.

Hall of the Franklin Institute, July 12, 1832.

The Board of Managers respectfully present to the Institute their report for the second quarter of the present year.

Preparations are making for the exhibition of American manufactures to be held in October next, and for the reopening of the schools and commencement of the lectures.

It is hoped that in addition to the usual courses, an efficient series of lectures on machines may be introduced. The difficulty in the

way of this important course lies in the models and machinery necessary for illustration. The Institute have not the funds to supply these. It is hoped that the zeal of the individual members may be relied upon to promote by the gift or deposit of suitable models and machinery, this useful and interesting object.

The Board of Managers have given the fullest consideration to the subject referred to them at the last Quarterly meeting, viz. the better accommodation of the lecturers of the Institute.

They find that an extension of the present accommodation could be obtained only in one of two ways; either by depriving the members of the privilege which they now enjoy in the reading room and library, or by taking from the institution revenues which are necessary to the payment of the interest on, and the gradual extinction of, the debt for which it stands pledged.

While, therefore, the Board consider that the better accommodation of the lecturers, by appropriating separate rooms to the lecturer on chemistry, and to the lecturers on Natural Philosophy and Mechanics, is very desirable, they cannot see in the present state of the institution circumstances which would warrant the undertaking.

Having twice in the course of this report referred to the limited nature of the funds of the Institute, the Board of Managers would take this occasion to submit a few remarks, in relation to the funds by which inquiries, connected with the objects of the Institute, have been carried on.

The expenses of the important experiments on water power were defrayed by individual contributions, and not by the Institute.

The later researches under the direction of the committee on explosions, were commenced at the request of the Secretary of the Treasury of the United States, and are making at the expense of the Department.

The sum appropriated to the committee on statistics has not been considerable in amount, and this amount was granted under the impression that a measure originating with the members of the Institute, at one of their quarterly meetings, must fail, unless the funds asked by the committee were provided.

The Journal of the Institute is now able to support itself, and will, probably, before a great while, redeem the loan made on its assumption by the Institute.

Thus it appears that important objects have been accomplished, and are accomplishing, without drawing from the treasury of the Institute the sums required to extinguish the debt for which it is pledged, and which, remaining unpaid, must always trammel the operations of the institution.

The Board announce with regret the resignation of Franklin Bache, M. D. Professor of Chemistry in the Institute. The efficient services of this gentleman have secured to him the respect and esteem of those with whom he has now for six years been connected.

Isaac B. Garrigues, *Chairman.*

William Hamilton, *Actuary.*

Thirty-fifth Quarterly Report of the Board of Managers of the Franklin Institute.

Hall of the Franklin Institute, October 11, 1832.

The Board of Managers submit to the Institute their report for the third quarter of the present year.

Since the last report several changes have taken place in the affairs of the institution, which are of interest.

The committee on Premiums and Exhibitions, by the advice of the committee of arrangement, determined to postpone the usual exhibition of domestic manufactures, in relation to the time of holding which they had received authority from the managers to decide. The gloomy state of a sister city, the apprehension which our own community, in conjunction with all others, felt in anticipation of the extensive prevalence of a wide spreading epidemic, rendered prudent the course adopted by the committee.

The resignation of our Professor of Chemistry, which the Board of Managers had the regret to announce in their last report, was followed by the appointment of John K. Mitchell, M. D. as his successor. The talents and attainments of this gentleman are well known to the members of the institute. The zeal with which he has entered upon the preparations for the ensuing course, give an earnest of his exertions to carry it to a successful completion.

On the last day of August, the rooms on the third floor of the hall were given up by Professor Johnson. The schools having at that time made their arrangements for the year, the rooms could not at once be rented. The Institute, on this account, though temporary sufferers, will ultimately be benefitted, since the delay has given time for a division of the third floor into six rooms. By this division the Drawing school and the English school will have suitable accommodations, a room for Models and Machinery be provided, and a rent be obtained.

The lectures for the ensuing season will commence on the last Monday in October, (October 25th,) the introductory lectures will be given on Monday, Wednesday, and Saturday, of the first week, after which the regular lectures of the course will commence. The chemical lectures will be given every Monday evening, those on natural philosophy every Wednesday, and those on machines every alternate Saturday evening. It is expected that volunteer lectures will occupy the alternate Saturday evenings.

The Board would again call the attention of the members to the promotion, by the gift or deposit of suitable models and machinery, or by donations in money, of the course on machines. Such a course as cannot fail to be useful as well as interesting has been sketched out by the lecturer on that branch, Franklin Peale, Esq. the completion of which must, in a great degree, depend upon the liberality of the members of the Institute. To those who have already come forward with subscriptions the Board return their acknowledgments.

The better accommodation of the Drawing school, to which the

Board has already alluded, is calculated to increase the popularity of that important school. The English evening school of the Institute, will be opened on Monday evening, October 15th, in the eastern room on the third floor of the hall. This school will be, as last year, under the charge of Seth Smith, Esq. It is hoped that the patronage of the members of the Institute, will be freely extended to this school; the qualifications of the teacher, and the highly creditable manner in which the system of his school was carried forward during the last year entitle him to their entire support.

The inquiries in practical science undertaken by the Institute are continued. The report of the committee on water wheels has, as far as the experimental part is concerned, been nearly completed, and that of the committee on the explosions of steam boilers is in progress. The branch of the investigations of the latter committee connected with the strength of materials, is steadily progressing. Many of the members have been present at a portion of the experiments, and have perceived the extent of labour which has been undertaken: time and great perseverance on the part of the committee are required to accomplish all the objects within the scope of the inquiries.

The diploma of membership has been prepared, and the insertion of the names of members is all that is wanting to make it ready for delivery.

Respectfully submitted.

ISAAC B. GARRIGUES, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

ANALYSIS OF THE REPORT, &c. ON STEAM CARRIAGES.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. (1832.)

The next witness examined was Richard Trevithick, the individual who, with Evans, first brought the high pressure engine into use; the first to attempt locomotion *on rail-roads* by the mere adhesion of the wheels to the rails. Trevithick informs us that he has for many years resided out of England, and indeed his testimony fully shows this, his ideas in relation to the high pressure engine being those of twenty years since: he gravely contends that every time the elasticity of steam is doubled a saving of seventy-five per cent. in fuel is made! he is full of a new project of a safe and most economical boiler, which he describes, and which he supposes will replace every other, whether used by water or by land, in ships or in fishing boats, in stationary or locomotive engines, on rail-roads or on turnpikes, for manufactures or for agriculture.

There are some interesting points in Mr. Trevithick's testimony, which, together with the description of his boiler, we give below.

Mr. Trevithick is of opinion that high pressure boilers have never exploded by the direct pressure of steam, unless when suddenly produced. In proof of this he states that portable gas holders are one-sixteenth of an inch thick, and ten inches in diameter, and are loaded with thirty atmospheres, or 450 lbs., and yet they never burst, while boilers of this, or greater thickness, have burst when provided with valves loaded to only one-eighth part of this pressure, and less. His theory of explosion is that of water suddenly thrown in foam upon the red hot sides of a boiler.

The new engine of Mr. Trevithick is thus described.

"The fire-place, boiler, and condenser are formed of six wrought iron tubes standing perpendicularly on their ends, encircled the one within the other for the purpose of safety, and to occupy little room, also for keeping the boiler to one constant gauge, with fine distilled water, permanently working without loss, by condensing the steam and never suffering it to escape out of the engine, but returning it from the condenser back again into the boiler every stroke of the engine by a force pump; and were an engine perfectly tight, it would work forever without a replenish of water. But, to supply leaks, a small evaporating apparatus is used for supplying the deficiency with distilled water, which effectually prevents any fluctuation in the height of water in a boiler or collection of sediment, and an impossibility of ever getting the boiler red hot, there being no space for the water to fly out of the boiler but into the condenser; and this is so small, that if, by any means, the force pump did not return the water regularly from the condenser to the boiler, the space in the condenser, by taking one inch in depth of water out of the boiler, would fill and glut the condenser so, that the engine would stand still, and, as the water cannot diminish it does not require a large quantity of water, or water space in the boiler, so necessary in other engines, to guard against fluctuation in the feed, and prevent the boiler becoming red hot. The boiler being considerably less, the strength and room will be increased, and, never getting hot, the engine might be worked with much higher steam; even as high as the pressure which gas holders are charged with, the theory gives a saving of fuel, weight, and room, over low pressure engines of sixteen to one, without a supply of water. I state this to show the probable advantages that will arise from this new engine. For my engine to be one hundred horse power, and to raise sufficient steam, the fire tube must be three feet diameter, which would give the boiler a diameter of three feet eight inches; and that a half inch thick, according to the theory of the strength of iron, would sustain a pressure of 1736 lbs. to the inch, which is four times as great as the gas holders are charged with, and thirty-two times the pressure that the high pressure engines work with at present, which is still farther proof that the explosions have been solely occasioned by the boilers being under water gauge, and heated red hot. If, after boilers have been forced on their trial by cold water pressure, to stand ten times the pressure that they are to be worked at, and a boiler should happen to explode, the shock would be first received by the next surrounding tube, and so on for six successive surrounding tubes; each space between the tubes would admit the steam to escape gently up the chimney without harm, and the outside tube that encircles the whole, might be made of three-quarters of an inch thick, so that it would put injury from explosion beyond possibility. The arrangement of this new engine embraces every advantage that can be wished for; safety, saving of fuel, lightness, little room, cheapness, simplicity, and nearly independent of water, it can be made applicable to any purpose, and much more effectual than horse power, the first cost of erection far less than a quarter the cost of horses, for the duty performed, independent of the difference of expense between coals and horses' feed, because a one horse engine will, by constant work, perform the work of four horses every twenty-four hours."

Mr. Trevithick's claims in relation to locomotion are so exaggerated that we quote before commenting upon them.

"Below is stated the commencement of both my high pressure and locomotive steam engines, with the advantages derived from them. Since 1804, at which time I invented and erected this high pressure engine, up to the present time, little improvement has been made in addition to my own. The first locomotive engine ever seen was one that I set to work in 1804, on a rail-road at Merthyr Tydvil, in Wales, which performed its work to admiration, and a correct copy of which is now in general use on the rail-road. The advantages gained by this improvement was a detached engine, independent of all fixtures, working with five times the power of Boulton and Watt's engine, without condensing water, and the fire enclosed in the boiler surrounded with water, and a forced draught created by the steam for the purpose of working on the roads without a high chimney; and from this was copied all the boilers for navigation engines, which, without it, could not have been made available; this being independent of brick work, light, safe from fire, and occupying little room."

With regard to Mr. Trevithick's attempt in 1804, it is admitted by the English author, Wood, not to have been successful, of which indeed we have the proof in the fact that Trevithick himself proposed to roughen the rims of his wheels to obtain greater adhesion; that Blenkinsop introduced the cogged middle rail, and that such crude contrivances as a chain stretched along the middle of the road, and the jointed leg, were proposed, and tried, to remedy the supposed defect of want of adhesion. It is just possible to see, in the imperfect way in which the escape steam acted in Trevithick's chimney, the germ of the method now employed, with such success, by Stephenson, for producing draught by its current.

Davies Gilbert, Esq. next presented to the committee for examination his judicious remarks upon wheels, springs, draught, &c. published many years since. As they have been for some time before the public, it is not necessary to insert them here. We extract certain additional remarks in relation to economy of steam conveyance, at different speeds, on land and on water.

"The slow conveyance of heavy weights may perhaps be effected by steam on well-made and nearly level roads, so as to supersede the use of horses; but steam power is eminently useful for producing great velocities. It was last year determined by the Society of Civil Engineers, after much inquiry and discussion, that the expense of conveying carriages drawn by horses was at its minimum when the rate of travelling equalled about three miles an hour, and that expense increased up to the practical limit of speed, nearly as the velocity; including the greater price of horses adapted to swift driving, their increased feed and attendance, the reduced length of their stages, and, with every precaution, the short period of their services. On the contrary, friction being a given quantity as well as the force requisite for impelling a given weight up a given ascent, the power required for moving steam carriages on a rail-way remains theoretically independent of its speed, and practically increases but a very little, in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c. The expenditure of what I have termed efficiency, is, as actual force, multiplied by velocity, and the consumption of fuel in a given time will be in the same proportion, but the time of performing a given distance being inversely as the velocity, the expenditure of fuel will, theoretically, be constant for a given distance, and very nearly so in practice. The power requisite for moving bodies through water is in the opposite extreme; here, the mechanical resistance of the fluid increases with

the square of the velocity, as do the elevation of the water at the prow, and its depression at the stern.* The oars, or paddles, must, therefore, preserve a constant ratio to the velocity of the vessel; and the force applied will consequently vary as the square of the velocity; and the expenditure of efficiency being as the force multiplied by the velocity; the consumption of the fuel will be as the cube of the velocity in a given time, or as the square of the velocity in a given space; and I have ascertained from the records of voyages performed by steam vessels, that the law is nearly correct in practice: hence the great power required for such steam vessels as are constructed not merely for speed, but also to set at defiance the opposition of winds and seas; while, on the contrary, a very small power will be found sufficient for moving ships of the largest dimensions through the water, at the rate of two or three miles an hour, when their sails are rendered useless by continued calms."

The next witness examined, Mr. Nathaniel Ogle, is joint patentee with Mr. Summers, in a boiler, engine, and carriage, adapted to locomotion on common roads. His testimony bears stronger marks of enthusiasm than of accuracy. He tells us that "rail-roads, except in very peculiar situations, are behind the age;" and we are disposed to believe that he gives full credence to his own remark. He does not seem to have been particular in measuring speeds or estimating weights, and treats the subject of tolls with considerable contempt. "I have paid near London, when trying experiments, a shilling or two, and I made no inquiry. I remember going out of London, throwing one man a shilling, and another two, being too much occupied to trouble myself about the matter."

The desideratum which Mr. Ogle considers to be realized in his boiler, is the combination of a great extent of heating surface with a limited space and perfect safety. The working pressure is 247 lbs. to the square inch on the safety valve. A description of the boiler is given which we cannot understand. It is said to present 250 square feet of fire surface in a space of three feet eight inches high, three feet long, and two feet four inches broad, and to weigh eight hundred weight.

The carriage has three wheels, the centre wheel being a guiding wheel. The adhesion of only one wheel is employed except in rising hills. The weight of the carriage and engine, with water and fuel, is stated at about three tons.

The results of trials of speed are given as from thirty-two to thirty-five miles an hour over a wet road with patches of gravel, which speed might have been continued for an indefinite time, or have been increased over a good road to forty miles. "From the turnpike gate at Southampton, to the four mile stone on the London road, a continued elevation, with one very slight descent, at a rate of twenty-four and a half miles an hour, loaded with people." "Ascended one of the loftiest hills in the district, near Southampton, at sixteen and a half miles an hour." "Ascended a hill with a soft wet bottom, rising one foot in six, at rather a slow rate."

A slope of one in six is about nine and a half degrees! When we consider that the greatest slope in our turnpike which crosses the Allegheny mountains is not greater than about five degrees, we are tempted to inquire where such a slope was found in the neighbourhood of London. The remarks of Mr. Ogle on the relative effect of horses' feet, and of the wheels of carriages upon turnpikes, are very judicious, but as we shall have occasion to refer to similar ones, it is not necessary to detail them.

* This is certainly an error.—Rev.

The next witness, Mr. Alexander Gordon, is an engineer, who states his principal experience to have been derived from the experiments of Mr. Gurney. He describes the two patents taken out by his father in 1822 and 24, both of which were unsuccessful. The first was a locomotive within a drum which it rolled along, propelling a coach in front. The second was a carriage moved by iron propellers.* Both the schemes proved failures.

The information given in relation to the relative wear of roads by wheels and by the feet of horses, seems to be founded on data of doubtful authority, and not skilfully used. The facts relating to the relative wear by steam coaches and the ordinary coach are of a different cast, and, to all appearance, have been drawn from close observation; the inference from them is that the wheels of a steam coach, the driving wheel included, do not do more apparent injury than those of the ordinary coach.

The testimony of Mr. Joseph Gibbs, engineer and patentee of a new boiler, and who was the next witness examined, presents no particular point of interest except that which relates to the freedom from slipping of the driving wheel in a locomotive; the carriage upon which the observation was made was Mr. Gurney's.

After travelling over a flinty road the tire was examined and found to be free from furrows extending around the wheel, which would have been produced had the wheel slipped.

The examination of Thomas Telford, Esq. is the next in order; it occupies but little space. The subjects to which it is directed are the relative injuries to roads by horses, by common carriages, and by steam carriages.

Mr. Telford considers that a horse does much more injury to a good road than the carriage which he draws, and that the mere pressure of a carriage can, in such a case, produce little effect. With regard to the question of the relative wear by common and by steam carriages, he professes a want of experience, but gives a qualified opinion in favour of the less injury which would be done by a steam carriage, than by a common coach of the same weight.

We next have the testimony of the partner of Mr. Ogle.

His statements upon points noticed in Mr. Ogle's testimony agree tolerably except as to speed, in the statement of which he is not very clear. He places the average speed at nearly ten miles an hour, the locomotive carrying nineteen persons. Then speaks of going up a hill, of a slope of one in twelve, at the rate of fifteen miles per hour. The discrepancy he attributes to the variation in the intensity of the fire. After a change made in the fire place is spoken of, Mr. Summers states that his carriage went frequently at the rate of thirty miles an hour for four miles and a half.

He gives a most favourable statement of the performance of his boiler, viz. "We have never found it necessary to clean it yet: it has been in operation more than twelve months." "We have had water of every description." "Every time we have arrived at our journey's end, we opened a cock communi-

* Both these locomotives are figured in the lithographic print entitled the "Progress of Locomotion. By Alexr. Gordon, Engineer."

cating with the bottom of the boiler; perhaps we do not give the matter (sediment) time enough to rest: it is all blown out at the pressure of 240 lbs. on the square inch."

The method of urging the draught is thus spoken of:

"Instead of blowing our waste steam into the chimney, in order to produce a draught, we have a fan or blowing machine, which is driven by the engines when in operation, and this gives us intensity of heat in the furnace. The waste steam from our engines goes into a double casing round the furnace; we admit a small portion underneath the fire bars of the grate, and the remainder is allowed to expand itself into the double casing, after which it comes over the top of the fire, and escapes in the form of invisible vapour.

"Then, in fact, you arrive at the same result, but with this difference, that you increase the draught of the fire by using a certain quantity of the power of your engine, whilst those who introduce the steam into the chimney increase the draught by a power which you throw away? We have tried it in both ways, but we find this the most advantageous, because in those carriages in which the steam is driven into the chimney to produce a draught, the aperture is so much diminished in order to produce velocity of current and corresponding increase of draught, that the waste steam is choaked in escaping from the engines, and produces a greater loss of power than by working the fan."

Mr. Summers' remarks drawn from his experience in the different varieties of road, &c. will be read with interest. He adheres to the slope of one in six, upon which we have remarked, and says that he has measured it: all men are liable to errors, and we repeat that one in six is nine and a half degrees.

"From your experience in steam carriages, do you conceive that it will be necessary to make any alteration of the present roads, such as paving them for the purpose of this mode of conveyance? No, certainly not; we have found that our vehicles will travel over every kind of road with great velocity, and up the steepest hills. From observation which I have made very minutely on the operations of the vehicle, my decided opinion is, that if the common roads were put into a tolerably good state of repair, we should be able to carry all the goods which a rail-way would be able to carry, and at much less expense, taking into consideration the original expense of the rail-way, and its continued wear and tear. I believe I have ascertained, from a correct source of information, that every yard of rail-way loses on an average about four ounces per year in weight, when it is in full operation. This loss arises from oxidation, and the action of the great numbers of wheels of the carriages that pass over it."

"Have you travelled over pavements? Very frequently."

"Did you find that your carriage travelled with greater ease over them? With much greater ease."

"Supposing you had a pavement to run on, what increase of power should you gain by running on that rather than on a common Macadamized road? We find that when we are travelling on a rough, bad pavement, we do not consume more than one-fourth of the steam we do on a gravelly soft road."

"You conceive you increase your power three-fourths on a paved road? Yes."

"What steepness of hill have you ever ascended? One foot in six; I measured it myself: that is, the hill at Shirley."

"Were there any symptoms of the wheel slipping in that case? Not the slightest: we had both the wheels in gear at the time we ascended it."

"At what velocity did you ascend it? At a velocity of nearly five miles an hour."

"What weight had you? We had fourteen or fifteen persons on the carriage."

"Did you find any difficulty in working? Our engines worked with perfect freedom."

"What distance did you travel on that ascent? The hill is about 200 yards long."

"You are now improving the form of the carriage—are you not? Our present operations are in improving the form of our vehicle, and the arrangement of the different parts of the machinery."

"For what number of passengers will your present carriage be calculated? Eight inside, and sixteen outside passengers."

"How many wheels have you? Our present vehicle is on three wheels; our proposed carriages will be on four wheels."

"In what space can you turn on a road? We have frequently turned entirely round on the London road leading from Southampton, in the space in which a post-chaise can turn, or rather less."

"Supposing you were travelling at the rate of ten miles an hour on a level road, in what number of feet do you suppose you should be able to stop your carriage entirely? We should be able to stop the vehicle in the space of twelve feet. I have ascertained this from experiment: when we were descending Staine's bridge, which is very steep, one of the crowd fell down in front of the vehicle, very near the vehicle; we immediately reversed the action of the engines, and the man escaped without any injury."

"When you state that you can stop in twelve feet, is that by reversing the action of the engines? No; by merely shutting off the communication between the boiler and the engine."

"But supposing you were in such a situation that it would be requisite to stop in a much shorter distance, could you do it instantaneously by reversing the engine? We could certainly stop in the space of three feet by reversing the engines; but it would not be prudent to do so in less, as it might endanger the lives of the persons on the vehicle by their being pitched or thrown forward."

Mr. Summers proposes tolls in proportion to the number of passengers carried, making those of steam coaches only one-half those of stage coaches, carrying the same number of passengers, on the ground of the less injury which they do to the road.

Mr. Stone, next examined, is the engineer of Sir Charles Dance's steam coach.

He states that they have run regularly for five months between Gloucester and Cheltenham, (25 miles?) with the occurrence of only a single accident, the breaking of an axletree. The greatest weight drawn he rates at eleven tons, and this was drawn at the rate of five to six miles an hour; the weight of the carriage was two tons. They have carried between three and four thousand passengers. This coach had been reported by the surveyor of the Gloucester and Cheltenham road as a nuisance, from the alarm which horses on the road took at it, noise, &c.

Mr. James M'Adam was next questioned, particularly in relation to the relative effect of wheels, and of the feet of horses, upon roads, and upon the method of charging tolls upon steam carriages. Pleading want of experience in relation to the effects produced by steam carriages, the information which he gives in relation to the latter question is conjectural. That referring to the effects of common carriages upon roads, and to the construction of these latter, will be read with interest.

"Have you made any experiments, or are you able to give any information to the committee, as to the comparative wear of roads, or injury to roads by carriages and horses passing? I have generally found that horses' feet do very great injury to the surface of a well-made road; and I am of opinion that a carriage, with properly constructed wheels, does less injury to a road than the horses' drawing.

"Would you explain what the operation of the injury done to the road is by travelling on it: is it the wear of the road, or the displacement of the materials? Both take place; the wheels, to a certain degree, wear out the material, but, upon a road properly constructed, and that has become consolidated, and the surface smooth, that wear is very small and gradual; the injury to the road from the horses' feet, more especially upon gravel and flint roads, arises, particularly in dry weather, from the knocking up and displacing the materials upon the surface, and each succeeding journey adds to the evil, and were it not for the effect of the wheels following the horses in mitigation of that evil, we should have the flint and gravel roads all loose throughout the whole summer."

"But the wheels of the carriage do not actually follow in the track of the horses? But in roads of much thoroughfare, especially near the metropolis, other carriages do."

"On the metropolis roads have you made any new regulations as to the mode of charging tolls, by weight or otherwise? In the last act passed for the metropolis roads, the toll was put upon the horse drawing, and a regulation as to the formation and breadth of the wheels expressly enacted, by which all wheels were required to be not convex, but a perfectly flat surface, with no projecting nails; but, by the powers granted to the commissioners in that act, that perfectly flat surface was mitigated to a surface not exceeding a quarter of an inch from the flat surface; to meet the practical effect arising from the wear of the wheels upon the road, and to prevent litigation at the several gates, by applying a gauge, a toll of 3d. per horse for each seven miles is payable upon a six-inch wheel so constructed; a quarter more upon a wheel so constructed of four inches and a half in breadth, and a half more upon a wheel less than four inches and a half. Those additions do not apply to stage coaches, or carriages with springs. The toll upon all horses drawing carriages and coaches with springs is 3d. a horse for seven miles, whatever may be the breadth of the tire."

"You have had no reference to the weight of the carriage drawn in your rate of the tolls? There is no reference to the weight drawn in any wagon or such like carriage, provided the wheel is of the construction required by the act, and the result of some years' experience proves that no injury whatever is sustained upon a well made road, from any weight practically carried in wagons, or such like carriages, with wheels as described."

"You do not mean that the committee should infer weight is of no consequence, but that the power of the horse will be your guard against an overweight being drawn? Yes; the toll being laid per horse, I consider that the penalty in the shape of toll per horse, more than compensates for the injury done by the weight. Before those regulations took place, the roads, in truth, sustained an equal pressure, from the well known fact that the weighing engines were universally compounded for by all the carriers, and that the roads after these regulations, had no greater but even less weights to sustain than before that took place, and it was observing that fact which induced the commissioners of the metropolis roads to do away with all the weighing engines."

"Do you know whether the Holyhead road commissioners are trying to do away with the necessity of weighing engines? Upon the trusts, on that line of which I am surveyor, the trustees have done away with all the weighing engines, and the happy result of compelling the wagons to set out and arrive upon the metropolis roads with properly constructed wheels, has had the effect of enabling the trustees upon all the roads within a circle of fifty to eighty miles, to dispense with the weighing engines; also, because if the wagons set out and arrive in the metropolis district with a properly constructed wheel, it was not

worth their while to alter it, but to travel throughout to Cambridge, Newmarket, &c. with the same wheel; and the benefit of the metropolis wheel has extended itself in consequence."

"Then supposing a broad wheel wagon with dished wheels was to pass through your turnpike, what rate would be charged? It would be charged the highest rate of a narrow wheeled wagon."

"Have you heard any complaints from the wagon masters of the regulation of the form of the wheel? On the contrary, a few days since, we had a petition most numerously signed by the wagon masters from Norwich, Cambridge, Newmarket, &c., requesting the trustees of the Wadesmill road to dispense with the use of their weighing engine, they having found by experience that the wheels required by the metropolis commissioners, were not only best for the road, but the most advantageous for themselves to use, and in consequence of that application, on Friday last, the only remaining engine on the roads of which I am surveyor, was ordered to be abandoned."

"Can you state the weights of a loaded stage coach, and a loaded wagon, and a loaded van, on the average? I should state a stage coach loaded, at from two and a half to three tons; a wagon from five tons to seven and a half."

"Does that include the weight of the wagon? Eight tons would; I should think the weight of the vans about four or five tons."

"Have you observed the operation of wheels when they are dragged? Yes; they are injurious upon roads newly coated certainly, but upon an old road, I mean a road that has become consolidated upon the surface, the injury, with proper skid pans, is but small, and confined, of course, to one side of the surface of the hill."

"Do you think the efficacy of your toll in protecting the road is equally applicable to a heavy van as to a loaded coach? I think that the toll per horse will always be a sufficient guard for the weights drawn; the van being on springs does infinitely less injury, in proportion, than such a weight without them."

"But if the injury to the road proceeds from the weight the horses have to draw, the same rate of toll would not be applicable to a carriage of two tons and one of six tons, both being drawn by four horses? Certainly not; but that is a supposition hardly fair to be taken, because we conclude that the additional weight requires additional horses."

"But in practice the vans pass all through the country with only four horses, and the coaches equally with four horses? That is true; the coaches go at a much more rapid pace."

"Do you think that the velocity with which a coach goes, has any thing to do with the wear of the road, or is it not actually less injurious in proportion to its velocity? In some instances, where any blow takes place, the speed does more injury to the road by crushing the materials."

"You did not contemplate the general use of vans when that act was drawn up? No; not that they would come into such general use."

"What proportion of the injury to the road do you think takes place from the changes of the atmosphere; frost and wet, has it any material effect? Yes, decidedly, in chalk soils in particular; at Royston, and through that country, a great and serious injury takes place upon the breaking up of all frosts, nor can we, by any care, or attention, or strength of surface of the road, prevent that taking place; it comes in a very eccentric manner, and breaks up one year at one part of the road, and another at another, occasioned in a great measure by the standing of the water in the sub-soil; and I suppose also, by the way in which the wind is at the time it freezes. It is the modern practice of road making to abstain from all general repair of the roads from the middle of April until the middle of October; during that period, the only repairs that ought to take place are partial coatings, necessary from accidental circumstances. As soon after the middle of October as possible, the general coating takes place in pieces of the road at a time, so as to interfere and interrupt as little as possible with general travelling; and we endeavour, by the month of February to have the whole of the coatings put on; in no instance above a sixth part at a time."

The quotations from the remarks of Mr. John Macneil, assistant engineer to Mr. Telford on the Holyhead road between London and Shrewsbury, and London and Liverpool, are, we think, of much interest.

"On an average line of road, of not less than 100 miles, on which, in many places, materials of very inferior description must have been used, both in its formation and subsequent repair, what is the maximum weight per wheel (say if not less than four inches width of tire,) which should be carried on any kind of carriage (carriage weight included,) without risk of injury to the road? On a road, such as here described, the injury will be considerable by any wheel passing over it, but without a more defined statement of the quantity and quality of the materials used, I do not think this question can be answered with any degree of certainty. On all gravel roads, however, made without a foundation or bottoming, I should say the weight on a four inch wheel, should not exceed fifteen cwt., and on a wheel less than that ten cwt. On the generality of roads, throughout the country, I do not think it would be safe to run a carriage with almost any width of wheel if the load much exceeded ten tons; in fact there are some bridges even between London and Birmingham, that it would be running a risk to pass over with a carriage weighing ten tons."

"Can you, from observation, say what proportion the breadth of the tire of wheels should bear to the weight? The breadth of tire in proportion to the weight, will depend entirely upon the description of road over which the carriage passes; on the road lately constructed by the parliamentary commissioners of the Holyhead and Liverpool roads, at the Highgate Archway, I have frequently observed wagons, carrying upwards of six tons, pass; the weight of each wheel on the road was then about thirty cwt., and though the bearing of the wheels, from the cause I have before stated, was not more than three inches, the effect produced was imperceptible. The pressure, in this case, was ten cwt. on every inch, which is unquestionably too much for the generality of roads; but if we take the road from London to Shrewsbury as a criterion to judge by, I should say that a wheel ought to be an inch in width for every ton that a carriage and its load weighs; and that if every carriage that now travels that road was limited not to exceed that proportion, the roads would be better, and maintained at a cheaper rate than at present. According to the average weight of coaches and wagons, as stated, I have calculated the following table, showing the weight at present carried on each inch of bearing, and what I conceive might be the breadth of the different wheels if they were made cylindrical, with an even bearing, and in the proportion of one inch of width for every ton including the carriage."

Description of carriage.	Velocity in miles per hour.	Weight, on an average, in tons.	Breadth of the wheels, in inches.	Pressure of each wheel, in cwts.	Pressure on each inch, in cwts.	Breadth of wheel, calculated in the proportion of five cwt. to the inch.
Mail coach,	9 to 11	2	2¼	10.0	4.40	2
Stage coach,	8 to 11	2½	2	12.5	6.25	2½
Van,	6 to 7	4¼	2½	21.25	8.29	4¼
Wagon,	2½ to 3	6	9	25.0	2.77	6
Ditto,	2½ to 3	4½	6	22.5	3.75	4½
Ditto,	2½ to 3	3½	4	17.5	4.37	3½

"State your opinion as to the relative wear of a road by two carriages, both drawn by four horses, one carriage of two tons weight, with two inch tires, the other four tons, with four inch tires? My opinion is, that the wear of the roads would in each case be the same, as far as it was affected by the wheels of the carriages, probably rather less, by the carriage carrying four tons, on four inch wheels, than by the carriage carrying two tons with two inch wheels; but it must be recollected that both the carriages are supposed to be drawn by the same number of horses, and as the horses drawing the carriage of four tons must use greater exertion than those drawing the carriages of two tons, I am of opinion that the aggregate wear of the road would be more by the transit of the four ton carriage, than by that of the carriage weighing two tons."

"How would the foregoing answer be affected by an increase or decrease of velocity in either carriage? If the road over which the carriages are drawn be hard, solid, and smooth, I think there would be very little increase of wear from the effect of the carriage wheels by an increase of velocity; but if the road should be uneven or rough, there would be an increase of wear, in consequence of the impetus, or blow, with which the wheels would strike the road after passing over the inequalities in its surface, particularly if the carriages were made without springs; but whether the road be a good or a bad one, the wear occasioned by the feet of the horses will be greater when they travel with an increased velocity: for a coach horse which travels at the rate of ten miles an hour, works on an average 270 miles in a month, and wears out in that time about four pounds of iron in shoes; whereas a wagon horse, which travels at the rate of three miles an hour, and works twenty-six miles a day, for four days in the week, goes, on an average, 416 miles in the same period of time, and wears out 4.8 pounds of iron. If the coach horse travels the same distance, the wear would be six-sixteenths, which exceeds the wear of the wagon horse one thirty-sixth. In the same way might the relative injury caused by the wheels of the wagon and the coach be ascertained."

"What is the operation of the atmosphere on roads? Well made roads, formed of clean hard broken stone, placed on a solid foundation, are very little affected by atmospheric changes; weak roads, or those that are imperfectly formed with gravel, flint, or round pebbles, without a bottoming or foundation of stone pavement, or concrete, are, on the contrary, much affected by changes of the weather. In the formation of such roads, and before they become bound, or firm, a considerable portion of the sub soil mixes with the stone or gravel in consequence of the necessity of putting the gravel on in thin layers. This mixture of earth, or clay, in dry warm seasons, expands by the heat, and makes the road loose and open: the consequence is, that the stones are thrown out, and many of them are crushed and ground into dust, producing considerable wear and diminution of the materials; in wet weather also, the clay, or earth, mixed with the stones, absorbs moisture, becomes soft, and allows the stones to move and rub against each other when acted upon by the feet of horses, or wheels of carriages. This attrition of the stones against each other, wears them out surprisingly fast, and produces large quantities of mud, which tend to keep the road damp, and, by that means, increase the injury."

"Supposing the actual wear or deterioration of a road to be represented by 100, and that only coaches, vans, and wagons, have passed over it during any given period, in what proportion would you estimate the effects; first, of atmospheric changes; secondly, of the carriage; thirdly, of the horses? This question can only be answered in a general way; no two lines of road would probably give results at all similar: much will depend on the manner in which the road is constructed, the materials of which it is composed, the care bestowed on its drainage, and whether it be in an open situation, or shaded by trees. If the road be properly made, and in an open situation, the injury arising from the atmosphere will be little, compared with the actual wear caused by the wheels of carriages and the feet of horses, probably not ten per cent. during the year; whereas, on weak roads in clay countries, every shower loosens the materials of which the road is

composed, and causes considerable wear, perhaps thirty per cent. or even more in some situations, where the road is shaded by trees; to get at something like an average proportion between the wear occasioned by horses' feet and the wheels of carriages, I have procured the following facts: the coaches which run between London and Birmingham, require a hundred horses, on an average, to work the up and down coach; the horses are generally shod by contract at about 2s. 6d. (55 cts.) per horse per month; those near London are much larger and heavier, and therefore require heavier shoes than those twenty miles out of London, and from thence to Birmingham; near London, in the flint districts, the wear of horses' shoes is much more than it is in the quartz and limestone countries. At Stoney Stratford, the weight of the four shoes of a mail and stage coach horse averages five pounds, and when taken off at the end of about twenty-eight days, they weigh very nearly two pounds: in this period the horses run 253 miles. At Towcester, Weedon, and Daventry, the weight of the new shoes is one pound and a half each, and, when taken off, they weigh nearly three-fourths of a pound; the length of time which they remain on is about thirty days; this would give a wear of three pounds per horse per month, but if the greater wear near London be considered, I think it would not be too much to allow the wear equal to four pounds per horse per month, which for one hundred horses for ten weeks, would give a wear of 1000 lbs. of iron. The hind wheels of the coaches are mostly four feet eight inches in diameter, and the front wheels, three feet. The width of tire, I before stated, is about two inches, and when new, the thickness of the iron is three-quarters of an inch. These wheels are found to last from two to three months, according to the state of the weather, the workmanship and quality of iron, (about twenty years ago they did not last seven days on an average;) suppose they now last ten weeks, in that time the tire is worn down to one-sixth of its original thickness. This would be equal to 163.4 lbs. or 326.8 for both coaches; this would be to the wear of the horses' shoes as 326.8 to 1000, or as 1 to 3-14ths nearly; now if the injury done to the road by the horses' feet and the wheels of carriages be estimated in the same proportion, I think it would probably be near the actual effect produced; that is to say, the injury done by the wheels of fast coaches is to the injury done by the horses which draw them, as one to three, in round numbers. The effect produced by slow carriages and horses is different: a wagon drawn by four horses, which travels regularly from London to Daventry at the rate of three miles an hour, is worked by fifteen horses; the wagon weighs twenty-five cwt. and carries, on an average, sixty-seven cwt.; the hind wheels are four feet eight inches in diameter, and the front ones four feet; the breadth of the wheels is six inches; they are nearly upright, but not cylindrical. The iron tire when put on, weighs on the fore wheel 285 lbs., on the hind ditto, 336 lbs., making 621 lbs. When removed, the weight is, on the fore wheels, 144 lbs., on the hind ditto, 168 lbs. making 312 lbs.; wear in five months, 309 lbs. The number of miles travelled in this time is 6,048; the shoes that are put on the horses employed to draw this wagon, weigh, when new, from two pounds and a half to three pounds each; the average of a great many gave two pounds and three quarters, and when removed one pound and a quarter. They last from four to six weeks, according to the weather, and state of the road; but we may assume five weeks as an average, and the wear in that time for each horse six pounds, and for fifteen horses for five months it would be 360 lbs. The proportion, in this case, would be as 309 to 360, or as 1 to 1.16, or nearly one to one and a fourth on the generality of roads: therefore I would say the proportion of injury would be nearly as follows, when travelled by fast coaches—

Atmospheric changes, - - - -	20
Coach wheels, - - - - -	20
Horses' feet that draw them, - - - -	60
	100

And when travelled by wagons—

Atmospheric changes, - - -	20
Wagon wheels, - - - - -	35.5
Horses' feet that draw them, - - - -	44.5
	100

"What is the effect of travelling by coaches and horses? whence, and in what proportion, does the injury or deterioration arise; is it from the crushing of materials; their actual wear; their displacement? If the wheels of carriages be properly constructed, and cylindrical, the friction, and consequently the wear on the surface of a well made road, will be very little, and there will be no injury from displacement of materials, except what may arise from the few surface stones that will sometimes be started out by the feet of horses on steep hills, when they are obliged to exert a great force to draw up a heavy load. When stones are thus thrown out on a hard and solid surface, the wheels of heavy carriages will crush them, and cause an injury which would be much more than that caused by the actual wear of the wheels passing over the surface. If the road be weak, or elastic, and bend, or yield, under the pressure of the wheels, the particles of which it is composed will move and rub against each other, or perhaps break by the action of heavy wheels over them. On such roads, I conceive the injury caused by steam carriages will be much greater in proportion to the injury caused by light carriages drawn by horses, than it will be on solid firm roads. In one instance, where an accurate experiment was made, the wear was found to be four inches of hard stone, when it was placed on a wet clay bottom, while it was not more than half an inch on a solid dry foundation, (formed as described in the report of the select committee on the Holyhead road, on the 30th May, 1830,) or with a pavement bottom, on a part of the same road, when it was subject to the same traffic. On the Highgate archway road, before mentioned, the annual wear does not appear to be more than half an inch in depth. Now, as this road is very little affected by wet, in consequence of its peculiar construction, and the care bestowed on its drainage, I attribute almost the whole of the diminution of materials to actual wear. On many roads, where the sides are weak, great injury arises from the crushing of materials, particularly by the action of wagon wheels. In frosty weather weak roads very frequently suffer more in one month than during all the rest of the year. In such cases, the injury is caused by the wheels of carriages, and not by horses' feet."

"The details of various kinds of steam carriages have been given to the committee; all act without propellers; without projections on the wheels; with cylindrical wheels; some with greater or less breadth of tire, even six inches wide; the power is applied either by crank or wheels to one or two propelling wheels, accordingly as greater or less force may be required. Some of the experimental carriages had three, some six wheels; all will have four wheels. Some have the engines in a separate carriage, and draw the load; some carry the load and engines on one carriage. Taking the above circumstances into consideration, which would be most injurious to a road—a stage coach, drawn by four horses, weight of coach three tons, horses two tons, breadth of tire two inches and a half; or steam coach, wheels four inches tire, weight four tons; in both cases velocity ten miles per hour? Taking for granted that the injury which a road sustains by the wheels of carriages, and the feet of horses is proportional to the wear of iron on the wheels and on the horses, and that the statement before given as to the actual wear on each be found correct, I would say the injury done to the road by the steam carriage weighing four tons with four inch wheels, would be less than that occasioned by the coach weighing three tons, drawn by four horses."

"Would it be beneficial, or otherwise, to the roads, that steam carriages, drawing heavy weights in carriages attached to them, should be substituted for wa-

gons drawn by horses, supposing that the weight of the drawing or propelling carriage should not in any case exceed the weight of the number of horses that would have been used to draw a corresponding weight, *e g.*"

Wagon,	8 tons.
Eight horses, 15 cwt. each,	6 ditto.
	14
On steam carriage,	4
Carriage drawn,	10
	14.—

I am of opinion, that if the steam carriage and its accompanying carriage be constructed with wheels of a proper width, and of the same diameter as the wagon wheels, and travel with the same velocity, that the injury on well made solid roads will not be more than that caused by the wagon and horses: in fact, if the proportion of injury before stated be correct, it will be less; but it must be recollected that weak roads suffer more than solid ones from the heavy pressure of wheels, and, in such cases, the steam carriage and its tender would be more injurious."

"In descending hills, steam carriages can regulate their velocity by reducing the action, or number of revolutions, of the wheels; this acts as a drag, but with this advantage to a road, that the wheel moves continually round: which would be most injurious to a road, the descent of a carriage dragged as usual (not omitting the operation of horses' feet,) or the steam carriage dragged or regulated in the mode described? Not having seen a steam carriage descending a hill in the manner described, (that is, regulated by the action of the engine on the wheel,) I cannot give a satisfactory answer to this question; but, as far as opinion goes, I should say that the joint action of the horses and drag would be more injurious than the steam carriage, the motion of which was regulated in the above manner, provided the wheels were of the proper width, and the total weight not greater than that of the coach and horses."

The plan of tolls proposed by Mr. Macneil is given in the following extract.

"The toll which carriages propelled by steam, or by any other mechanical means, should be required to pay, ought, in my opinion, to be in proportion to the injury they would do to the roads compared with that done by the present description of carriages, and the horses employed to draw them, without reference to the weight or quantity of goods carried; but, as I before stated, I do not believe an accurate estimate can be, at present, formed as to the injury that roads may sustain from steam carriages, compared with the injury done to them by coaches drawn by horses. It may, however, I think, be safely assumed that the injury done to a road by a steam carriage would not be greater than that occasioned by a stage coach drawn by horses, the weight of the engine and its load being supposed not to weigh more than the stage coach, together with its load and horses. If this be granted and an act passed limiting the width of wheels in a certain proportion to the weight carried, there would not be much difficulty in arranging a scale of tolls applicable to steam carriages, which would put them on an equitable footing with carriages drawn by horses. If, for instance, a proportion, such as I have already mentioned, be adopted, viz. that a wheel should be an inch in width for every five cwt. it has to support, and a toll charged for each inch equal to the amount charged for a horse drawing in a carriage which travels with the velocity of the engine, it would, in my opinion, be a fair and equitable toll, at least for some years, or until a correct proportion of injury was ascertained by experience and observation, when it might be altered or amend-

ed according to circumstances. This mode of charging toll would be extremely simple, and not likely to be misunderstood by toll-collectors, or to occasion any disputes; but there should be a heavy penalty attached to the proprietors of steam carriages if they put a greater weight on the carriage than the wheels were intended to carry. If the engine, instead of carrying the load, draws one or more carriages after it, the toll should be collected and charged on each carriage in a similar manner as it is charged on the engine, that is, in proportion to its wheels. An example will illustrate my meaning more clearly: suppose an engine, together with its load, to weigh nine tons (which is about the average weight of two stage coaches, including the weight of the horses which draw them) to pass through a toll gate where horses drawing coaches are charged 6d. each, the toll on the two coaches, would be 4s., and of the steam carriage 4s. 6d. Suppose that the engine, instead of carrying the load, draws a carriage after it, and that the weight of the engine is five tons, with five inch wheels, and of the accompanying carriage four tons, with four inch wheels, the toll of the engine would be 2s. 6d., and of the tender 2s., making 4s. 6d. as before. The only objection I can see to this mode of charging toll on steam carriages travelling over the turnpike roads, would be, that, in the event of their being able to carry a greater number of passengers at a cheaper rate than the present description of carriages drawn by horses, it would lessen the amount of toll collected, as a fewer number of carriages would do the work, and many persons who drive their own horses would travel by them if found cheaper to do so; and this circumstance, although it would not affect the state of repair in which the road was previously maintained, might lessen the value of property invested in the different turnpike trusts throughout the kingdom, which is a very considerable sum; but such circumstances should not militate against an invention likely to prove beneficial to the country at large."

Mr. Macneil states that he saw Mr. Gurney's steam coach carrying eight or ten persons over one of the worst roads "in the country," at the rate of five or six miles an hour; he saw several horses both under the saddle and in harness pass Mr. Gurney's carriage without noticing it.

Mr. Macneil is of opinion that no road should have an ascent greater than one in thirty (about two degrees,) or one in thirty-five, and that the expense of such roads would be saved in a few years in the diminished labour of transport. The ascents between London and Birmingham are given as sometimes one in fifteen (about three and two-thirds degrees.)

The testimony of Col. Torrens, a member of the committee, and the last witness examined, is directed to the effect which would be produced upon the agricultural interests by the substitution of steam power for horse power. Upon such a subject there is much room for speculation, and we consider the analysis of this report as terminated without adding one more to the speculative opinions for which this new subject has already given room.

B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1832.

With Remarks and Exemplifications, by the Editor.

(Continued from p. 333)

36. For *Fastenings for Bedsteads, Sofas, &c.;* John P. Allen, Manchester, Essex county, Massachusetts, May 19.

The nature and antiquity of this invention will be rendered appa-

rent by the claim, which is to "the application of the right and left hand iron screw to bedsteads, sofas, and couches, for the purpose of fastening together into solid frame work." We have neither time nor inclination to ascertain how many patents have been issued for putting bedsteads together by right and left handed screws, but recollect several; in some of them it is proposed to make the screws of wood, and in others of brass. Whether or not *iron* has been mentioned we cannot say; and, if not, the present patentee has the "forlorn hope" of sustaining his claim, by a strong material, it is true, though not by any thing which he has *invented* or *discovered;* he having merely substituted one well known material for another, which attains the same end, and by the same means.

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37. For a *Machine for Cutting Laths;* Ira Carpenter, Cincinnati, Hamilton county, Ohio, May 21.

This machine is described with sufficient clearness, but the drawing which accompanies it is unworthy the name.

Two methods of constructing the machine are mentioned, in both of which the cutting knives are made to revolve. According to the first, or main plan, a quadrangular frame is to be made by joining four pieces of timber strongly together; this frame is to be hung by a shaft, or pivots, passing through the middle of its sides. Across one, or both, of its ends a long knife, say one of four feet, is to be fixed, and by this knife boards are to be cut into laths. The frame is made to revolve by means of whirls on its shaft; the cutting knife is to have such a curve on its outer side as is due to the circle in which it revolves, and the inner side is to be made concave, having regard to the necessary strength. The cutting edge is not to be straight, but hollowed, so that when its ends come in contact with the board, its middle may stand at a distance of two inches. The knife should be from three to five inches in width.

The board to be cut is placed upon a suitable bed piece, with which the knife, in its revolution, comes nearly into contact. The board is made to advance against a stop, which gauges the thickness of the lath, being forced up by a rack.

The second method of forming the machine is to take a beam of about nine feet in length, and to hang it so that it may revolve upon a shaft, or gudgeon, passing through the middle of it. Along each of the ends of this lever a knife is bolted, of sufficient length to cut a lathe. These knives may, in this case, be straight on their edges, and may be made to cut at one end first.

The claim is to the construction of the concave and convex knife, and its application as described; and also to the combination and application of the other parts to the purposes set forth.

On the 16th of March, a patent was granted to Simon Willard, of Cincinnati, for a machine in most points similar to this, the main difference being in the concavity of the knife. See p. 163.

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38. For a *Washing Machine,* called the double cylinder wash-

ing machine; John S. Pulsifer and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, May 21.

This machine is so truly a counterpart of that patented by Mr. Simon Savage, on the 11th of April last, and described p. 236, that we shall merely refer the reader to the account there given, for a full display of the present invention.

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39. For a *Stereotype Block;* Bradbury Hackett, Boston, Massachusetts, May 21.

This is entitled an improvement in moving forward the *hookers* of the stereotype block.

The two moveable hookers have shanks to them, which are placed in excavations made for the purpose, in the block. These shanks are surrounded by a spiral spring, which may be made to act in either of two ways; it may force the hookers against the edges of the plate, so as to hold it by their continued pressure; or it may force them from the plate, and be kept up against it by the action of a cam, or turn-buckle, against a plate of brass, by which they are connected. The drawing represents the former arrangement. There is a cam, or turn-buckle, which, when a key is inserted, acts upon the middle of a piece of brass, the ends of which force the hookers against the plate, the cam being retained in its place by the falling of its end into a slight depression on the brass plate. We should think the first described arrangement the best, as the distance to which the hookers are carried cannot, by this latter mode, be varied by the spring, and is not, therefore, so well adapted to any difference in the width of a stereotype plate.

Instead of using the spiral springs, it is proposed sometimes to substitute a bar of steel for that of brass, giving to it such a form and thickness as shall cause it to serve the double purpose of lever and spring.

The claim is not to the individual parts, but to the general arrangement of them for the purpose to which they are to be applied.

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40. For a method of *Attaching Leather Soles to Boots and Shoes of India Rubber;* Wait Webster, city of New York, May 21.

An in-sole of leather is to be put within the shoe or boot, and a corresponding out-sole and heel are placed on the outside, when the whole is to be attached together by nailing, pegging, or sewing, in the ordinary modes of performing these processes.

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41. For a *Machine for Sawing Timber;* Jackson Blood, of Trumbull, and Samuel A. Hurd, of Huntingdon, Fairfield county, Connecticut, May 22.

What is intended for a description of this machine does not explain either its construction or mode of operation; and the drawing, although it is good as a picture, is very far from supplying the defect of the specification. It appears, however, that saws are to be

stretched in a saw frame, and that this saw frame is to work horizontally within the general frame work of the whole apparatus. A horizontal shaft, with its proper gearing, crank, and pitman, is to vibrate the saw frame. The timber, according to appearances, is to be placed, by some means, under the saw, the frame of which, as the teeth enter, is to sink down upon it. The thing, as represented, appears to be altogether incapable of being worked, and will, in this case, be secure from all successful attempts at piracy.

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42. For a *Machine for pressing, fluting, and bending, Tortoise Shell, Horn, and other Combs;* Reuben Munson, city of New York, May 22.

We looked for some new kind of press to be described in the specification of this patent, but found nothing more than a common hand screw press for forcing convex and concave, or other dies together. The patentee, however, says that the dies, or moulds, are a material part of the "*invention;*" of the *apparatus*, he should have said, as we usually apply the term invention, in the way in which it is here used, to those things only which are supposed to be new; a supposition which no one can, in the present instance, entertain, who is in the slightest degree acquainted with the various manufactures of tortoise shell, horn, &c.

It would be difficult to ascertain at what period it was *not* known, in Asia and Europe, that "horn or shell, annealed, or softened, in hot oil, or other liquid, or in any other convenient way, and pressed" into moulds, would receive, and, when cold, would retain, the impression of the mould, yet for doing this, and precisely in this way, the present patent is taken. We had occasion two or three years since to notice the obtaining of a patent for the same purpose, and then spoke of the entire want of novelty in the alleged invention.

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43. For an improvement in the *Blast Furnace for Smelting Iron Ore;* Thomas Gregg, Connelsville, Fayette county, Pennsylvania, May 22.

The interior of this furnace is to be circular, and three feet in diameter at the boshes, widening out to three feet six inches at the tunnel head. Within the body of the stack there are to be two air flues, which are to create a draught for two small furnaces on one side of the superstructure, which are called generating furnaces. The flame created by these furnaces is to be brought into contact with the blast at the tuyere, in order to produce ignition at that part in which the force of the issuing blast ordinarily prevents it, and in this way to obviate the collection of cinder, which usually proves so troublesome by adhering around the tuyere.

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44. For an improved *Printing Press*, denominated the "Faustus Printing Press;" Seth Adams, Boston, Massachusetts, May 23.

We shall not attempt to describe the manner of arranging the va-

rious parts of this press. The patentee claims "the combination of the crank, the cam, and other parts together, so as to move the platen, or frisket, and produce the effects described." The press is to be operated upon by hand, a handle being attached to a fly wheel for that purpose, as in several other presses.

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45. For a *Smut Mill;* Stephen Fellows, Sandwich, Stafford county, New Hampshire, May 24.

A wheel of about eighteen inches in diameter is made to revolve vertically in a suitable frame. This wheel has upon its edge, a rim or hoop of sheet iron, which projects over on one side in the manner of the rim of a sieve, and is perforated with holes to allow smut and dust to pass through. Nails, or pins, are driven into this wheel, and project about an inch from it. They are so driven as to form concentric circles about an inch and a half apart. This wheel revolves against a stationary board, a little larger than the wheel, and having nails, or pins, also driven in circles, occupying the spaces between the circles on the wheel. The stationary board is perforated at its centre, so as to form an eye through which the smutty grain is to be fed. Appended to the apparatus is a hopper, and suitable riddles for feeding and separating the grain, and a fan for cleaning it.

The grain, in passing from the centre to the circumference of the revolving wheel, is operated upon by the projecting pins, and also by the rim with its perforations, which cause it to be rough within. The claim is to the wheel and fixed board, with the pins arranged in the manner described.

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46. For an improvement in the *Apparatus for Baking or Roasting*, usually called the reflecting tin baker; William Prescott, Boston, Massachusetts, May 24.

This is confessedly the common tin kitchen, but an improvement in it, is claimed, which consists in placing the pan or trough which collects the gravy close to the front, and allowing the lower part of the kitchen to slope forward so as to carry all which falls upon it into the trough. This constitutes the invention, and forms the subject of the claim.

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47. For an improvement in *Bedsteads:* Bethel Judd, New London, New London county, Connecticut, May 25.

The bedstead is to be made and put together in the common way, the new invention consisting in an ancient mode of stretching the sacking bottom. To effect this it is to be nailed to loose rails which slide by means of tongues fitting into grooves in the head and foot rails. Screws passing through the side rails of the bedstead, work in nuts let into the slide rails, and serve to tighten the bottom. A short rail, or rather a block, according to the drawing, is to be attached to the head and the foot end of the sacking, a single screw through the head and foot rails working into each.

In the old English fashion, a single sliding rail was used at the

head only, with screws passing into it through the head rail, and thus drawing the bottom lengthwise, whilst it was corded at the sides. We have heard English cabinet makers say that were they to return to England, they would introduce the American fashion of cording upon pins, as being preferable to any other. When the sacking is nailed to a rail, as in the plan of the patentee, it forms a secure harbour for bugs, as is well known in our common cots. The screw holes also offer inviting retreats to the same unwelcome bedfellows, and abstract very much from the commendation which any one might otherwise be inclined to give to such a mode of tightening sackings.

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48. For a *Sector Tonsillarum*, being an improvement in surgery; William B. Fahnestock, Lancaster, Lancaster county, Pennsylvania, May 25.

The form of this instrument is that of a stem, or shank, of a fifth of an inch in diameter, with a ring on one end of about an inch and a quarter in diameter. The stem is perforated from end to end, to allow a rod, or wire, to pass through it, which rod, or wire, is furnished with an ivory handle at the end opposite to the ring. The ring is split through its plane, and the split, or kerf, extends up the shank a distance equal to the diameter of the ring. A piece of steel plate is made in the form of this ring, with a rod, or wire, projecting from it of sufficient length to pass through to the upper end of the shank, and receive the ivory handle. When these are all in their places, the three thicknesses of which the ring consists, coincide. The inner edge of the lower half of the steel ring is made sharp, and when it is desired to remove a tonsil, or other soft part, the ring is passed over it, and the ivory handle being drawn forward, it is separated by the cutting edge.

The patentee states that the ring may be made to consist of two parts only, one sliding upon the other, but that he prefers the former method.

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49. For *Machinery for washing and cleaning Paper Makers' Felts;* Samuel E. Foster, Brattleboro, Windham county, Vermont, May 25.

A hollow cylinder of metal, from four to ten inches in diameter, is to be perforated with holes over its whole surface, its length must of course be such as will adapt it to the machine in which it is to be employed.

The felt is to be made to pass round this cylinder, and is to be borne against it by smaller rollers of wood, and so secured by boxing that but little water shall escape from the perforated roller without passing through the felt. Two other wooden rollers serve to squeeze the superfluous water out of the felt, as it passes between them. Steam may be applied when requisite for the purpose of rendering the felt pliable. The water, or the steam, is to be introduced through hollow gudgeons at each end of the perforated roller.

50. For a *Washing Machine;* Ezra Fisk, Fayette, Kennebeck county, Maine, May 25.

A vibrating rubber, composed of fluted pieces and of rollers, is to operate upon the clothes so nearly in the manner of many other washing machines, that we think a particular description of this, is unnecessary. The patentee considers it as a very superior article, and should the public concur with him in opinion, their praise will be of more value to him than any we are prepared to bestow.

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51. For a *Filtering Machine to be used in the art of manufacturing Paper;* Thomas French, Ithaca, Tompkins county, New York, May 26.

This machine is to perform the task of what has been usually called a pulp dresser, some of which instruments we have formerly described. A cylindrical vessel of copper, or of brass, is to be made with slots, or openings from top to bottom, exhibiting the appearance of bars about one-fourth of an inch wide, and one thirty-second part of an inch asunder. It may be made solid, and afterwards cut in this manner, or it may be composed of metallic bars put together. It may also vary in its form, being either square, polygonal, or otherwise. Its diameter may be fifteen, and its height fourteen inches.

A perforated dasher is to be made to play up and down in this vessel, by means of a crank, giving a velocity of from five to six hundred strokes in a minute. The pulp admitted into it is thus forced through between the bars into a vat below, whilst the knobs, &c. are retained, and are removed, when necessary, through a suitable opening. The rim of the dasher stands about half an inch from the sides of the cylinder, and in its vibration approaches the bottom within half an inch, and the top within four or five inches. To supply the cylinder with stuff, a conductor of the requisite size passes through the top, or cover, of it.

The cylinder is enclosed within a close, square box of wood, and one which has been made of the given dimensions, supplies a machine vat which works the pulp beat by two engines. The driving power is said to be equal to about that of a man. If the metallic vessel is made sufficiently strong, so that the bars will not yield to the pressure, the necessity of picking the paper after it is dried, is said to be obviated altogether; whilst, from the agitated state in which the pulp is thrown into the vat, the fibres are more perfectly entangled than is general in machine paper, and it is thereby improved in quality.

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52. For a *Washing Machine;* Ebenezer Mayo, Hallowell, Kennebeck county, Maine, May 26.

A drum, or hollow cylinder, which we suppose may be about two feet in diameter, is hung so as to turn vertically in a tub, or trough, the lower edge of the cylinder dipping into the soap suds contained in it. A smaller cylinder, one-fourth or one-fifth the diameter of the former, either plain or fluted, is placed above it, and is caused to revolve by it, the large cylinder is turned by a winch, and the small

one is made to bear upon it by springs operating upon its gudgeons. The large cylinder is generally covered with slats placed at a small distance from each other; upon this the articles to be washed are laid, being confined to it by hitching some string, or other small part, between the slats, or otherwise.

It is recommended, in order to prevent the splashing of the suds, to enclose the whole in a box, which must be furnished with a door on one side to inspect and regulate the operation.

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53. For a *Horizontal Water Wheel;* Sheldon Stoddard, Jackson, Susquehanna county, Pennsylvania, May 28.

We have here a very imperfect kind of wheel, described with corresponding vagueness. The drawing, however, shows enough of its general construction to prove that it is not new in principle; and as similar wheels have been often tried, we are well assured that it will convey as little of the power of the water to the mill as any wheel well can. The buckets are hung in the manner of doors, or shutters, which are to open and present their broad sides to the current on one side of the wheel, whilst they are to swing and present their edges on the opposite side. Buckets of this description always appear to be very perverse things when set to work, refusing to open at the period set down for them, and thus losing a great part of the time in which it is intended they should labour.

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54. For a discovery in *Bleaching Cotton, Linen, and other Cloth;* John B. Greene, Portsmouth, Rockingham county, New Hampshire, May 29.

This discovery consists in first impregnating with alkali the cloth to be bleached, and then subjecting it to the action of chlorine gas, in a suitable apparatus. The alkali, it is said, protects the cloth from injury by the gas; it is afterwards to be cleaned in any of the known ways, and passed through a weak solution of sulphuric acid.

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55. For *Rendering Fish Oil Drying;* David C. Knapp, Charles K. Knapp, and Allan H. Howland, Oswego, Oswego county, New York, May 29.

The patentees claim "the preparing and manufacturing the aforesaid oils by chemical agents, in such a manner as shall cause them to dry, and render them fit and proper for all the purposes of painting and glazing, to which linseed oil may be applied.

The mode of effecting this is to boil the oil with litharge, red lead, white lead, white vitriol, or other metallic oxides, or salts. The quantity of the oxides being proportioned to the time in which it is wished that the oil should dry.

Fish oil has been rendered drying, and used for the purpose of painting, many years since. We published a description of a mode of doing this in the first volume of the Franklin Journal, in June, 1826, which we extracted from a volume of the Transactions of the

Society for the Encouragement of Arts, &c. published some years earlier. The recipe there given is as follows—

In refining 252 gallons (one ton) of fish oil, there will be used thirty-two gallons of vinegar, twelve pounds of litharge, twelve pounds of white vitriol, twelve gallons of linseed oil, and two gallons of spirits of turpentine. The drying ingredients are first to be added to the vinegar, and well mixed with it, by agitation, twice a day for a week. This is then to be added to the whale oil, well mixed, and is to be allowed a day to settle, when it is fit to be poured off, and to have the linseed oil and turpentine added to it. Colours prepared with it are said to be bright, and more durable than those used with linseed oil.

It appears, therefore, that the claim to the rendering of fish oil drying by means of chemical agents, is one the novelty of which cannot be sustained.

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56. For *Apparatus for Cooking, and for Heating Rooms;* Jacob Stahl, city of Baltimore, May 29.

There is not much pretension made to invention in this patent, the merit of the apparatus being said to rest upon the particular arrangement of its respective parts. It consists of a stove made of cast and sheet iron, with an oven, in the usual form for cooking, and dampers for regulating the flues. The flues, or pipes, for heated air, are made double, and the space between them is filled with pulverized charcoal, or other bad conductor. When the weather is warm, and the oven is used for cooking, the heat passes off by a short flue; when the heated air is required for warming rooms, a long pipe with elbows, operating as drums, is employed. The claim made is to the particular construction of the apparatus.

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57. For a *Metallic Stereotype Block;* Samuel Sawyer, Boston, Massachusetts, May 29.

(See specification.)

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58. For an improvement in the *Box and Hub of Wheel Carriages, and in the method of Hanging Coach Bodies;* David Watson, Fayette, Kennebeck county, Maine, May 29.

Boxes are to be made of cast iron, of the usual form on the exterior, but with a rebate at each end in the interior, so as to receive a copper ring, cast for the purpose, which is to be five-eighths of an inch deep, and three-fourths thick. These rings are driven in against a shoulder on each end of the cast iron box, and are secured by riveting; they form the bearing for the axle, the bore of the cast iron between them being such as to allow a space of three-eighths of an inch between it and the axle.

A hole is to be bored through the hub and the iron box at the middle of the axle, for the purpose of supplying oil. A sponge is to be placed in this hole to retain the oil and lubricate the axle, and it is closed by means of a screw, to prevent the entrance of dirt and water.

In hanging carriage bodies, the first improvement described is the putting of steel rollers three inches long, and an inch and a quarter in diameter, at the upper ends of the jacks, over which the thorough braces pass. Under the body of the carriage, and extending from one end of it to the other, over, and in the direction of, the perch, an elastic beam, or strip of wood passes, which is three inches wide, and an inch thick, and this is connected on its under side to levers, by strong spiral springs, which are arranged in a way which could not be clearly explained without the drawings, but which are intended to give the most perfect elasticity to the whole structure, and are, it is averred, capable of being so managed as to cause the passenger to ride with equal ease, whether a stage be loaded lightly or heavily.

The claim is to the copper rimmed boxes, and the mode of applying them; the adaptation of the iron boxes to them; the mode of supplying the oil; and the described manner of hanging the bodies of stages, or other carriages.

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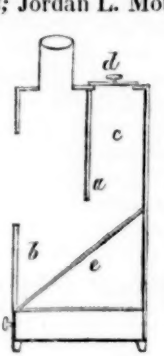
59. For an improvement in *Stoves for Burning Anthracite Coal;* Jordan L. Mott, city of New York, May 30.



The improvement here proposed, consists in dividing a stove into two parts by a partition which reaches to the top plate, but does not descend to the bottom of the stove, as is shown at *a* in the section in the margin. The fire is to be lighted at *b* in the usual manner; the part *c* is to be filled with coal, and the cover *d* placed on, which will give a continued supply of fuel by the descent of the coal down the inclined plate *e*, as that in the front is consumed.

The claim is to the dividing of the stove, and the fixing an inclined plate, and grate, for the descent of the fuel.

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60. For an improvement in the *Silk Reel;* Charles G. Green, Windsor, Windsor county, Vermont, May 30.

The improvement here described is intended to distribute the silk upon the reel with perfect regularity, and thus to prevent the occurrence of the defect which is known by the name of glazing; and consequently to produce silk of a better quality than can be obtained by the common reel. To effect this purpose the reel is made to traverse backward and forward with perfect regularity; this is done by lengthening out the gudgeons of the shaft of the reel, so that they shall each form cylindrical rods of the full length of the reel itself. These turn in boxes upon the frame of the reel, having a crank upon one of them for that purpose.

These rods may be about an inch in diameter, and upon one of them two channels are cut from end to end, one of these forms a right, and

the other a left handed screw. A guide piece in one of the boxes, acting alternately in these grooves, causes the reel to traverse backward and forward. This is the part which forms the subject of the patent, it being the only one in which this reel differs essentially from others.

As there are two cylindrical rods, we should suppose that it would be better to have the right hand screw on one of them, and the left hand screw in the other; as in the machine described, these grooves cut each other in their crossing, at every turn. The principle of action would remain the same, although in the case suggested each box must have its guide piece, which could be engaged and disengaged by very simple gearing.

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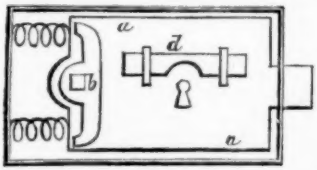
61. For *Spring Catches or Locks for Doors;* Robert J. Byram, Boston, Massachusetts, May 31.



We cannot give the precise structure of this lock without a more lengthened description than we can allot to it. One of its principal features, however, is the making the bolt in such a way that it forms a frame, the rim of which slides against the sides of the box of the lock, as seen at *a a*. The tumbler *b*, standing in the centre of this, draws the bolt back, which is forced forward by the spiral springs *c c*. A small bolt, *d*, shooting against the frame, may serve to lock the door. The patent is taken for these and certain other particular arrangements.

Specifications of American Patents.

Specification of a patent for a Metallic Stereotype Block. Granted to Samuel Sawyer, *Boston, Massachusetts, May* 29, 1832.

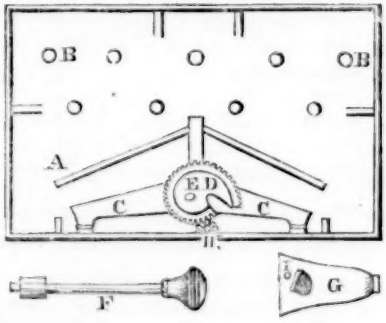
To all whom it may concern, be it known, that I, Samuel Sawyer, of Boston, in the state of Massachusetts, have invented a new metallic stereotype block, to be used for the purpose of holding stereotype plates in the process of printing, and that the following is a full and exact description of my said invention.

Instead of forming the stereotype block of wood, in the usual way, I make it of metal, hollow on the underside, and generally cast in one piece, either of iron, brass, type metal, or any other suitable metal, or mixture of metals. Instead of being cast, however, they may be made of sheet metal, in the manner of the iron boxes of common door locks. To support the face plate, or that upon which the stereotype plate is placed, I cast, or otherwise affix within the block, studs, or partitions, of metal, sufficient in number for that pur-

pose, and extending down from the inside of the face plate, so as to bear upon the platen when on the press.

Upon one edge of the face of the block, I cast, or otherwise affix, permanent clasps, or catches, of the usual form for holding the plate; and through openings in the face of the block, at the opposite edge, project the moveable clasps, or catches. These moveable catches, which work through slots or mortices in the face plate, are attached to, and make part of, a metallic plate placed within the block, and sliding against the under side of the face plate. In order to force the catches against the edge of the stereotype plate, I employ an eccentric or spiral wheel, having on its periphery cogs, or teeth, which wheel is acted upon by a key passing through an opening in the edge of the face plate, between the two moveable catches. This key is furnished with teeth, which, taking into those on the edge of the eccentric or spiral wheel, enable the operator to force up or retract the catches at pleasure. The principle upon which this eccentric, or spiral wheel, operates, will be more clearly shown by a reference to the drawing thereof deposited in the patent office.

What I claim as my invention, and for which I ask a patent, is the using of a metallic stereotype block, constructed in the manner herein described; and also the manner in which the moveable catches are operated upon by a key, and an eccentric or spiral wheel, as above set forth, whether the same be made in the exact form represented, or in any other operating upon the same principle, and producing the same effect.



A, under side of the block.
B, B, studs.
C, metallic plate carrying the moveable clasps.
D, spiral toothed wheel, turning on the pin E.
F, key for turning the wheel, and moving the catches.
G, plate which covers the wheel.
H, stop which acts against a rim on the spiral wheel, bearing it against the key.
I, hole for the point of the key.

Specification of a patent for a Pulp Dresser for the purpose of separating the knobs, or grosser particles, from the pulp used in the manufacturing of Paper. Granted to COLEMAN SELLERS, *city of Philadelphia, June* 6, 1832.

To all whom it may concern, be it known, that I, Coleman Sellers, of the city of Philadelphia, in the state of Pennsylvania, have invented a new and improved pulp dresser, for the purpose of separating the knobs, or grosser particles, from the pulp, in the manufacturing of paper, and that the following is a full and exact description of my said invention.

I form a pulp wheel, or dresser, which is made to revolve within the machine containing the pulp, by the application of power in the ordinary way. Fig. 1, in the accompanying drawing, is an end view of the wheel, or dresser, the opposite end being in the same form, and the two being connected together by plates of brass, or other material, which form a complete casing thereto. This wheel, or dresser, is represented as carrying six dressing plates, to be presently described, but this number may be varied as may be found convenient. Fig. 2 is a perspective view of the wheel, showing the plates which pass from end to end, one half of which are plain, and the others so perforated as to form the dressing plates, or strainers, for the pulp. The plates which are perforated to form the strainers I generally place so that their planes form radii with the centre, or axis of the wheel as seen at A A in the drawing. The plane, or unperforated plates, may, at their junction with these, at B B, form a right angle with them; but the form of the plates, and the angles at which they stand, may be varied, without changing the principle upon which they operate. Instead of making the plates flat, they may, for example, be bent so as to form a curve from their exterior to their interior points of junction, as shown by the dotted line C C, fig. 1.

The lines drawn upon the plates A A, fig. 2, represent slots, openings, or perforations, cut through those plates, and forming them into strainers, which allow the finer portions of the pulp to pass through, and arrest the knobs, or coarser particles. These perforations may differ in width, according to the kind of paper to which the dresser is to be applied, but I sometimes make them so that they can be graduated, and the same wheel, or dresser, answer for every kind required. This I accomplish by making the plates double, and perforating them so that when laid upon each other the openings through the two plates shall exactly coincide. By sliding one plate upon the other, by means of a regulating screw, or otherwise, they may then be readily graduated.

D, fig. 2, shows the shaft by which the wheel, or dresser, may be made to revolve. One of the heads of the dresser is open, as at E E, and through this opening the pulp which has been cleaned from the knobs and coarser particles escapes; this end revolves in a hoop, or collar,

fixed in an opening in the side of the vat, or machine, in which the dressing is effected.

The most advantageous way of using this wheel, or dresser, is to fix it at such height in the machine as that when one of the plane or unperforated plates F F F F, is upwards, and horizontal, it shall coincide, or nearly so, with the line of the surface of the water; the machine, however, will work if entirely immersed, but not so advantageously.

The perforated faces of the wheel, or dresser, in its revolution, meet the floating pulp, and as they strike against it, the finer parts pass through to the inside, whilst the coarser are arrested; and at the same time, these coarser particles are prevented from accumulating on the surfaces of the strainers by the agitation produced by their striking against, or upon, the fluid.

What I claim as my invention and for which I ask a patent, is the use of a revolving wheel, or pulp dresser, which carries the dressing plates, or strainers, causing them to strike against the fluid containing the pulp, and allowing the dressed portion to pass through to the inside of the wheel, or dresser, acting upon the principle, or in the manner hereinbefore described, whether the same be made in the exact form represented, or in any other producing the same effect.

COLEMAN SELLERS.

Fig. 1.

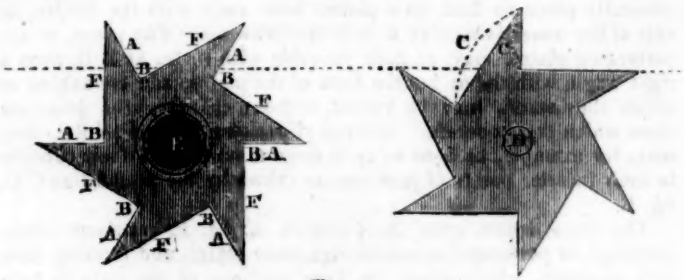
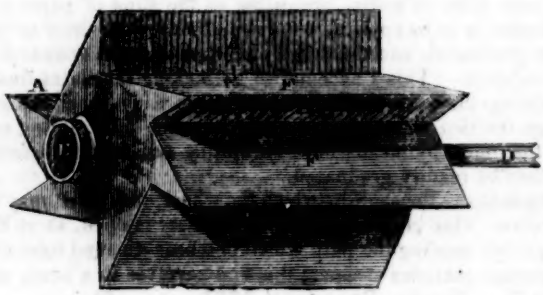


Fig. 2.

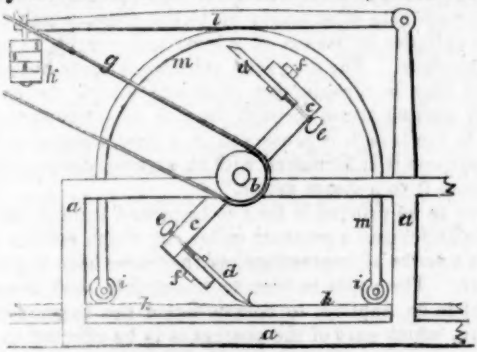


ENGLISH PATENTS.

Patent to M. Muir, *Engineer, for improvements in machinery for preparing Boards for Flooring, and other purposes. Granted December* 22, 1831.

In the third volume of the present series of the "Register,"* page 65, we have described a machine, by this patentee, for performing at once the several operations of sawing, planing, grooving, and tonguing flooring boards, and his present patent is for an addition to the same, by which the boards are reduced to a uniform thickness, and therefore completed for laying on the joists. For this purpose the boards are laid upon their faces, or planed sides, and made to pass under a set of revolving adze cutters, by which they are reduced to uniform thickness. The annexed is a sketch of the revolving adzes, where *a a a* show a cast iron frame, with a pulley, or trigger, for giving motion to the cutters *b b*, which are connected with a horizontal axis by means of the rectangular arms *c c; e e* are adjusting screws, to regulate the depth of cut; and *f f* are binding screws, for securing the cutters when adjusted. *g g* show a band by which the motion of the steam engine, or other first mover, is transmitted to the revolving cutters. *h h* show the board to be acted upon, and *i i* are two rollers resting upon the board, and by means of the weight *k*, the lever *l*, and the bent frame *m m*, prevent the board from rising while under the operation of the cutters.

The boards are brought forward to the cutters by means of a chain passing over a drum situated where the frame is shown imperfect. From different links of the chain descend hooks, which hold the end of the board and force it forward as the drum revolves, and when the last end of the board is brought under the drum it is to be pushed forwards by the introduction of another board, and a hook from the



* Mr. Muir's patent, upon which this is an improvement, was obtained on the 1st day of June, 1827. It is described in the Register of Arts, as above, and also in the London Journal of Arts, vol. ii. second series, p. 68.

chain applied to the farther end of that, and so on in succession, during the operation of the machine.

The favourable opinion which we formerly gave of Mr. Muir's planing machine has been completely borne out by the success of the machine, and we have every reason for believing that the patent before us will prove an important addition to his former invention.

[*Reg. of Arts.*

Patent to T. J. Potts, R. Oliver, *and* W. W. Potts, *for an improved method, or process, of obtaining impressions for engravings in various colours, and applying the same to Earthenware. Granted September* 17, 1831.

The employment of a rolling press, to print the intended impression on a continuous web of paper, appears to be the principal object of these patentees. The paper on which the impressions are to be made, is first subjected to the process of sizing. For this purpose, an apparatus, consisting of a sizing trough, in which turns a feeding or supplying roller, over which is placed a sizing roller, both being covered with flannel or printing blanket. These rollers being turned till the flannel becomes saturated with size, a third roller is placed over them, and round this is coiled the web of paper, as it is sized by the pressure of the upper against the middle roller.

The upper roller, with the coil of paper upon it, is then removed to the printing machine. This consists, first, of a colour trough, with a roller to transfer the colour to a metallic cylinder, on which is engraved the design to be transferred to the earthenware, porcelain, glass, &c. To the surface of the engraved cylinder is applied a doctor, or scraper, consisting of a straight steel blade, extending all the length of the cylinder, straightened by pieces of metal, being screwed to each side of it nearly up to the edge, which is pressed against the cylinder by means of a lever and weight, to remove the superfluous colour. The engraved cylinder is made hollow, that its temperature may be considerably increased during the operation of printing, by passing steam through the axis on which it turns, while the colour in the trough is preserved in a fluid state, also by steam, for which purpose it is furnished with an exterior casing and communications from it to a steam boiler.

The paper to be printed is then to be passed through between the engraved cylinder and a pressure roller, by which process are transferred to it a series of impressions, as they have been engraved upon the cylinder. The paper is then to be cut into such pieces as may be required to be applied, to communicate the impressions to the earthenware, which part of the process is to be effected in the usual manner.

When it is necessary (as it is stated to be sometimes) to engrave the intended design on a flat plate, heat is to be communicated by placing the plate over a metallic steam box, instead of over a charcoal

fire in the usual way, and making it to traverse forwards and backwards by means of a crank and connecting rod, care being taken, by stuffing boxes, to preserve the communication between the steam boiler and heating box. [*Ib.*

Patent granted to JOHN COWDEROY, *for manufacturing Bread and Biscuits. Dated October* 14, 1831.

This invention is to make bread on a large scale, or to prepare in a shorter time a greater quantity of loaves than manual labour can produce. There is a wooden vessel, tub, or trough, in which is first prepared the liquid matters which form so large a portion of our bread loaves. What these are, Mr. Accum has told us we ought not particularly to inquire into, if we would eat heartily. But setting aside all thoughts of dried bones pounded, alum, yest, potatoes, salt, water, &c. we will suppose the liquor prepared in this wooden vat, or trough. It has a large wooden cock near the bottom, which being open, its contents are issued into an inclined pipe, or channel, or conductor to the kneeding trough. Over this channel is a flour box duly prepared, attached to which is a drum, or cylinder, begirt with rows of brushes, or bristles, to temse or cleanse the flour, forcing it in equal quantities through a wire sieve, so as to make it mix equally, gradually, and completely with the liquor, in order to make a sponge in the kneading trough; it is then allowed to rise, and when the ingredients are added which are necessary to complete its doughy character, it is removed on a long rail-way to a part of the bread manufactory, in which is situated a large frame with a variety of moulds of different sizes and shapes. When the dough is thus made into loaves, or moulded into the prescribed form, it sets off on another rail-way journey, and is conducted safely into the oven in the way most conducive to its easy and speedy baking. When that time comes, the other end of the oven is opened, and an immense feather-edged peel, which moves on wheels, is introduced, and the huge baking is removed in large quantities, and at few batches, from the oven. The process is equally applicable to the production of biscuits, and the whole invention would have been attributed in ancient days to the direct influence and inspiration of the much worshipped deity *Jupiter Pistor.* What a grand accompaniment to the commissariat department of an army, or to the *provant* stores of a besieged garrison! [*Rep. Pat. Inv.*

Patent to J. MABURY, *and* J. MABURY, JR., *for improvements in polishing and manufacturing Ladles, Spoons, and other articles of tinned iron. Granted January* 24*th*, 1832.

The application of a pair of planishing rollers, highly polished, and mounted in a manner similar to that usually adopted for flatting

rollers, constitutes the principal part of the improvements contemplated by these patentees. The tin plates are polished by being passed through between the rollers previously to their being formed into ladles, spoons, or other articles of culinary use. In stamping the polished plates into the forms for which they are intended, dies of the usual form, but of much finer finish, so as not to injure the polish of the plates, are to be employed. The articles are then to be finished in the manner usually adopted in completing the manufacture of spoons, ladles, and other culinary utensils.

[*Reg. of Arts.*

FRENCH PATENTS.

Patent granted to Monsieur Le Petit Lamasure, *Jr., Founder, at Rouen, and proprietor of the Forges in the Department of Lot-et-Garonne; for a double case furnace Tewel, supplied with water, and a moveable tube within, to regulate the current of air, for the purpose of economising the combustible and the workmanship; also to obtain a greater proportion of iron.*

General observations upon the inconveniences of ordinary Tewels, and of their position.

The most experienced manufacturers of iron have agreed that the inclination, more or less, in the placing of the tewel, is sufficient for obtaining a fourth, and sometimes even a third, less of the ore, than is procured when the same tewel, by its position, forms a strict angle agreeing with the vertical line that passes by the axis of the furnace.

But supposing that it be easy and convenient to place this tewel, so that the current of air be introduced into the furnace with every requisite advantage, we must admit that it will suffer no derangement or descension during the whole course of the operation, which we cannot allow; for upon this point, and up to the present moment, an imperfection has existed which involves the inevitable causes of the loss occasioned by these said tewels. In fact, after having bestowed much time and pains in the construction of a furnace, wherein scrupulous attention has been observed in properly disposing a tewel of the ordinary form and manufacture, it is no unusual occurrence to find it insensibly altering, and the mouth of the air-pipe changed in figure, and augmented—and this at every instant: a serious inconvenience, because the same quantity of air issuing by two orifices of different dimensions, and propelled by the same force (their relative speed being an inverse ratio to the orifices,) it follows that if the primitive orifice give vent to proper swiftness, and in a convenient direction, it is certain that the one which manifests deterioration will not fulfil the same functions: thence follows the necessity of replac-

ing the worn tewel, in order to make it perform the same duties, which is an operation at once laborious, expensive, and attended with difficulties, on account of the immense heat with which the furnace is impregnated not allowing of a near approach to it; besides which, there results a waste of time; a mass of combustible burned almost without effect; a decided loss of material in the produce, where a given quantity of iron was expected: and, finally, that iron of a bad quality is produced whenever the tewel has been burned.

Means of obviating the inconveniences which arise from the employment of the ordinary tewels.

The double tewel here represented was constructed to remedy the evils just described. This machine is not liable to deterioration upon being exposed to the violence of the fire, because it serves as a reservoir of water that is continually renewed; or, in other terms, because a small course of water passing between the double case, maintains it constantly in a state of freshness, and prevents it from being burned.

It will be seen that in constructing the furnace, after having properly arranged the tewel, it may be firmly fixed, because it will never be susceptible of being deranged from its place; for by means of a conical tube, similar to that of fig. 4, the dimensions of the orifice for the current of wind to be introduced into the furnace may be altered in a moment, according as the operation may require, whether to vary the speed, or the bulk; and this, too, without the direction of it in any case being changed.

By means of this new tewel with its reservoir of water and interior tube, the necessity of the workman is superseded, who is commonly employed the whole year round to repair and readjust the original machine, and who is usually hired at the rate of seven or eight francs a day.

The double case tewel is applicable to every description of tewel, no matter of what form or species.

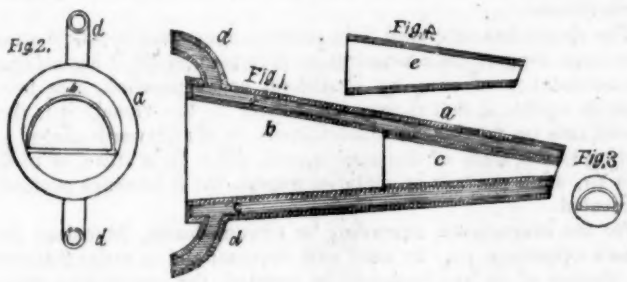


Fig. 1, longitudinal section of the tewel.
Fig. 2, end view in the quarter of the large opening.

Fig. 3, view of the extremity opposite to that of fig. 2.

A, exterior conical case, in brass.

B, interior case, of the same metal and form.

C, annular space reserved between the two cases *a b*, and containing water.

D D, pipes serving to introduce water into the space *c*, and to carry it off.

E, figs. 1 and 4, a small, simple tube, of a conical form, to be inserted at pleasure in the double tube, or tewel, *a b*, in order to graduate the quantity of air that is required to be introduced into the furnace, without any other derangement than that which is necessary to change this small tube for another, the orifice of which is conformable with the effect desired and expected.

[*Rep of Pat. Inv. from Brevets d'Inventions.*

Patent granted to SOPHIE VICTOIRE LAINE, *for a process for making Gelatine from Bones without muriatic acid, yielding a residuum which may be used as excellent nourishment.*

The beef and mutton bones used in this process are first cleared from the flesh, washed, and completely broken up. When so prepared the bones are placed upon the fire or exposed to steam, with a sufficient quantity of cold water, in an autoclave, or one of Papin's condensing coppers or *marmites;* the upper part being secured by an iron bar, with one or several screws.

The fire, or steam, is urged to a considerable degree for several hours, until the time that the water in the copper, or marmite, has possessed, by ebullition, the whole of the gelatine contained in the bones: after the fire, or steam, has ceased to act, and when the phosphate of lime, entirely deprived of gelatine, is precipitated to the bottom of the vessel, the liquor is drawn off by the means of several cocks adapted to the copper; it is clarified, and, if necessary, afterwards filtered.

The water thus saturated with gelatine is exposed to fire or steam in an open copper; the concentration is carried on till it has attained the consistency of sirop by ebullition, or evaporation, care being taken to agitate it that it may not adhere to the vessel: it is then poured into tin moulds, in which it cools, to be afterwards placed according to the state of the atmosphere, either in a stove, or in the open air, upon canvass or metallic frames, till it becomes perfectly desiccated.

For the evaporation, according to circumstances, Monsieur Derosne's evaporator may be used with success; and in order that even the shadow of an accident may be avoided, the condensing copper described above is supplied with an escape, in the upper part, for giving vent to the redundant steam or air, and which mechanism is controlled in the following manner.

Several circular iron plates are provided, a few inches in diameter, and more or less thick, each of which has a hole in the centre; if the steam escape too forcibly during the boiling, one of these plates is put upon the escape of the condensor, so that the orifice of the escape may correspond with the hole in the plate: this simple apparatus, whilst allowing the escape of the air, or steam, contained in the boiler, immediately controls its too violent release by the action of the heat. If one plate be insufficient, two or three are added, one upon the other; more than four are seldom required, and this feeble moderator is sufficient for avoiding bursting or explosion.

The muriatic acid is totally unnecessary in the process here described, which is unexceptionably salubrious, its residuum, moreover, having the property of being highly nutritious, and of imparting no corrosive and deleterious principle, as occurs in the employment of muriatic acid. [*Ibid.*

¶ *Remarks on Mr. White's experiments on the cohesion of cements, with a tabular view of their results, reduced to a common scale. By B. Bevan, Esq.*

To the editors of the Philosophical Magazine and Journal.

Gentlemen,—The papers on cements, communicated by Mr. White, and published in the Philosophical Magazine and Annals, N. S. vol. xi. pp. 264 and 333, are of considerable importance on account of the numerous facts they contain. They enable the architect and builder to know where, and in what manner, to apply the different kinds of cement, and the degree of stress which may safely be laid upon them.

A careful perusal of the numeral results will point out several common errors, in respect to the cohesive properties of Roman cement and pozzolano, under different modifications, and under various degrees of exposure to moisture.

And as you probably may be of opinion that an abstract of the results given in those papers, reduced to one common scale in a tabular form, may be acceptable to some of your readers, and save much time to individuals, I take the liberty of sending one.

			lbs.	Cohesive strength per inch. Mean.
Cement in bars, age 6 days,	1 dry	-	474	
	2 variable	-	360	356
	3 wet	-	234	
" age 47 days,	1 dry	-	516	
	2 var.	-	564	
	3 wet	-	270	
" age 94 days,	1 dry	-	210	
	2 var.	-	618	380
	3 wet	-	312	

"	age 187 days,	1 dry -	534	
		2 var. -	708	519
		3 wet -	336	
	Mean of the dry -	-	433	
	variable -	-	562	
	wet -	-	288	
	With salt water, -	-	924	
	With 51 per cent. of water, -	-	330	
	With 64 do. -	-	215	
	3 parts cement, 2 parts sand,	-	456	
	1 part cement, 1 part brickdust, -		312	
Bricks	3 parts cement, 2 parts sand, 6 months,		375	
	3 —— —— 2? -	-	362	
	All cement -	9 months,	360	
	Paving bricks, best sort,	-	253	
	——, seconds, -	-	194	
	Common building brick, London,*		43	
	Common bricks, Soho, -	-	412	
Brick cylinders, laid in cement,		-	27	
—— in cement and sand,		-	68	
——,		-	48	
——,		-	53	
Brick piers, laid in cement, 2 parts rough lime, 1 part, sand, 1½ parts,		1 month		4⅓
pozzolano, 3 parts, docking lime, 1 part,		6 weeks,		7
pure cement, -		-	21	
pozzolano, 1; stone lime, 1,				8¼
Atkinson's cement, 1; sand, 1,				25¾
ditto, -		-		49¼
cement, 4; lime, 1,		-	17	

The apparent deficiency of strength in these experiments, probably arose from the position of the resultant and strain in being on one side, instead of in the middle of the piers.

Force required to crush, per square inch.

		lbs.
P. 337.	A 14 inch brick pier, laid in cement	470
	Pozzolano, 3 parts; ground lime 1,	296
	Atkinson's cement 1; sand 1, -	410
	Pozzolano, 4; lime 1, -	638
	Ditto 3; Dorking lime 1, -	600
	Stone-lime 1; sand 3, -	500
	Portland stone pier, -	2300

* Stowbridge fire bricks have a strength of 790 lbs. per square inch. The bricks I used at Greenwich well were made at Fenny Stratford, and would support 715 lbs. per square inch; equal to the strength of Yorkshire stone.

A small error may be corrected, Phil. Mag. and Annals, vol. xi. p. 339, line 20, *for* 173⅛ tons, *read* 149 tons.

Yours, truly,
B. Bevan.

P. S. From the disproportions between the cohesive strength of pure cement and cement used in brick work, it is desirable that further experiments should be made on this subject.

¶ *Safety Tube for the combustion of the mixed gases Oxygen and Hydrogen, invented by M. Hummings.*

A cylinder, about six inches long, and three-quarters of an inch wide, filled with very fine brass wires, in length equal to the tube. A pointed rod of metal, one-eighth of an inch thick, is then forcibly inserted through the centre of the bundle of wires in the tube, by which they are wedged more closely together. The interstices between the wires, which are exceedingly small, are then, in effect, a series of metallic tubes of very minute diameter; the cooling and conducting power of these is far greater than could be produced in a cylinder of equal length even filled with discs of wire gauze, and there is unbroken continuity. All attempts to produce explosion of the gases in this tube, or to compel the flame to return through it, have been effectual. Before the Society of Arts, Mr. Hummings exploded the gases repeatedly in the improved safety chamber now employed in Gurney's blow-pipe, by permitting small portions of water from the well to enter with them, but he could not explode them in his improved tube under precisely the same circumstances, although they were ignited at the aperture (nearly three-quarters of an inch in diameter,) after the jet was removed.

Mr. Hummings kept the gases ignited at this large aperture until the extremity of the tube was in a state of active combustion, which was evident by the dense green flame produced; and although the cooling influence was then greatly diminished, no explosion occurred.

The simplicity of its construction will render the manufacture of the article easy and economical, and its perfect safety will enable the chemical operator to dispense with a very expensive and delicate article of apparatus, in the use of which there is always danger and uncertainty.

[*Phil. Mag. and Jour of Science, No.* 1, *3d series.*

Trials of Chronometers at Greenwich, in 1831.

We can advance no better evidence of the advantage of the government offering rewards for the improvement of science than the results of the last year's trial of chronometers at the Royal Observatory, and contrasting with them the particulars of the trials in former years, showing the gradual improvement and accuracy of performance of

the several chronometers that gained the respective prizes. The public are aware that the lords of the admiralty give annual premiums to the three artists whose chronometers perform with the least variation from mean time, within prescribed limits. In December terminated the ninth annual trial of skill of the numerous artists employed in the construction of chronometers. The prizes were awarded to the following makers, whose chronometers at former periods have been repeatedly purchased by the government. The errors at the close of the trial, as computed by the astronomer royal, and determined by what is termed the trial number, were as follows:

Mr. Cotterell, Oxford street,	2.93	Trial number.
Mr. Frodsham, jr., Change alley,	3.65	
Mr. Webster, Cornhill,	3.73	

But the actual error, on any of their rates during the year, did not amount to one second of time—a degree of accuracy unprecedented in three chronometers in former trials, in which more than five hundred have been submitted for observation: so perfectly were they adjusted, that either would have enabled a mariner to navigate a vessel round the world with less than one mile error in longitude at the close of such voyage. The errors in their rates were

Mr. Cotterell's	0.70
Mr. Frodsham's	0.86
Mr. Webster's	0.89

leaving a difference in the whole year, between the first and last, of nineteen hundredths of a second. To prove the accuracy and attention of the gentlemen of the Royal Observatory—a question having arisen as to the justness of awarding one of the prizes, the sum of the year's errors was revised, and the result was a difference of .066 decimal, or sixty-six thousandths of a second in the year's calculation; determining the prize to Mr. Webster, as proposed in the first instance.

We subjoin the performance of the chronometers for the last eight years' trials:—

1823.	First prize	11.29
	Second do.	12.87
1824.	First do.	4.44
	Second do.	6.84
1825.	First do.	5.44
	Second do.	6.12
1826.	First do.	2.62
	Second do.	3.46
1827.	First do.	4.68
	Second do.	5.65
1828.	First do.	4.41
	Second do.	4.52
1829.	First do.	2.27
	Second do.	3.80
	Third do.	4.00

1830.	First do.	- -	3.59
	Second do.	- -	4.04
	Third do.	- -	4.34

[*Phil. Mag.*

Substitute for Printing.

A new process has been discovered and brought into use at Brussels, whereby French books and journals may be printed with great facility and perfect accuracy. It consists of an operation by which, in less than half an hour, the whole of the letter press upon a printed sheet may be transferred to a lithographic stone, leaving the paper a complete blank. By means of a liquid, the letters transferred to the stone are brought out in relief within the space of another hour, and then, with the usual application of the ordinary printing ink, 1500 or 2000 copies may be drawn off resembling minutely the original typography. The immense advantages of this discovery, for which M. Mecus Vandermacien has solicited a patent, may be easily conceived. A first application of this discovery has been made by him upon the "Gazette des Tribunaux," which is to appear at Brussels under a new title.

[*Rep. Pat. Inv.*

Curious Clock.

The Journal of Geneva gives the following description of a clock exhibited in that city, and executed by M. Bianchi, of Verona. This machine, which is especially remarkable on account of its extreme simplicity, is composed only of a pendulum, a large wheel, two escapements, and a quadrature; such are the visible parts. We must, however, suppose that a pinion and a wheel make the communication between the great wheel and the quadrature, though we cannot see them. The pendulum at each vibration causes one of the escapements to advance the great wheel one tooth, which, after this movement, has a pause marking the dead second. As there is no metallic moving power to set the machine going, we find, on examining what keeps up the motion, that the pendulum, which is almost out of proportion with the clock, descends into a case, and there, at each vibration, the ball, or bob, that is furnished with a conductor, approaches alternately two poles, to which voltaic piles supply their portion of electricity. So that the pendulum, when once put in motion, retains it by means of the electricity alternately drawn from the two poles. This machine, which is equally simple and ingenious, is worthy of the attention of the artist. Perhaps other interesting results may be obtained by employing the electric fluid as a moving power, however slight the force such an agent may seem capable of communicating. [*Rep. Pat. Inv.*

The Iron of Borneo.

The iron found all along the coast of Borneo is of a very superior quality, which every person must know who has visited Pontiana or Sambas. At Bangermassing, it is, however, much superior; they have a method of working it which precludes all necessity of purchasing European steel. But the best iron of Bangermassing is not equal to that worked by the rudest Diak; all the best kris-blades of the Bugis rajahs and chiefs are manufactured by them; and it is most singular, but an undoubted fact, that the farther a person advances into the country, the better will be found all instruments of iron. Seljie's country is superior in this respect to all those nearer the coast; his golloks, spears, and kris-blades are in great demand.

There are forty-nine forges at work merely in the campong of Marpow, but the mandows and spears which he uses himself, and gives to his favourite warriors, are obtained further north. Those men live in a state of nature, building no habitations of any kind, and eating nothing but fruits, snakes, and monkeys, yet procure this excellent iron, and make blades sought after by every Diak, whose hunting excursions have in view the possession of the poor creatures, spear or mandow as much as his head, strange as it may sound.

Instruments made of it will cut through over wrought and common steel with ease. We have seen penknives shaved to pieces with them by way of experiment; and one day a wager of a few rupees having been made with Seljie, that he would not cut through an old musket barrel, he without hesitation put the end of it upon a block of wood and chopped it to pieces without in the least turning the edge of the mandow.

In the sultan of Cotti's house there are three muskets, formerly belonging to Major Mullen's detachment, which are each cut more than half through in several places by the mandows of the party which destroyed them. This circumstance being mentioned to Seljie, he laughed, and said that the mandows used on that occasion were not made of his iron, otherwise the barrels would have been cut through at every stroke.—*Abridged from an article in the Singapore Chronicle.*

¶ *Selections from Professor Babbage's Work "on the Economy of Machinery and Manufactures."*

Machine for making Pins.

Some further reflections are suggested by the preceding analysis, but it may be convenient previously to place before the reader a brief description of a machine for making pins, invented by an American. It is highly ingenious in point of contrivance, and, in respect to its economical principles, will furnish a strong and interesting contrast with the manufacture of pins by the human hand. In this machine,

a coil of brass wire is placed on an axis; one end of this wire is drawn by a pair of rollers through a small hole in a plate of steel, and is held there by a forceps. As soon as the machine is put in action—

1. The forceps draws the wire on to a distance equal in length to one pin: a cutting edge of steel then descends close to the hole through which the wire entered, and severs a piece equal in length to one pin.

2. The forceps holding the wire moves on until it brings the wire into the centre of the *chuck* of a small lathe, which opens to receive it. Whilst the forceps returns to fetch another piece of wire, the lathe revolves rapidly, and grinds the projecting end of the wire upon a steal mill which advances towards it.

3. After this first, or coarse pointing, the lathe stops, and another forceps takes hold of the half pointed pin, (which is instantly relieved by the opening of the *chuck*,) and conveys it to a similar *chuck* of another lathe, which receives it, and finishes the pointing on a finer steel mill.

4. This mill again stops, and another forceps removes the pointed pin into a pair of strong steel clams, having a small groove in them by which they hold the pin very firmly. A part of this groove, which terminates at that edge of the steel clams which is intended to form the head of the pin, is made conical. A small round steel punch is now driven forcibly against the end of the wire thus clamped, and the head of the pin is partially formed by pressing the wire into the conical cavity.

5. Another pair of forceps now removes the pin to another pair of clams, and the head of the pin is completed by a blow from a second punch, the end of which is slightly concave. Each pair of forceps returns as soon as it has delivered its burthen; and thus there are always five pieces of wire at the same moment in different stages of advance towards a finished pin. The pins so formed are received into a tray, and whitened, and papered in the usual manner.

About sixty pins can thus be made by this machine in one minute; but each process occupies exactly the same time in performing.

Economy in manufacturing illustrated.

Among the causes which tend to the cheap production of any article, and which require additional capital, may be mentioned, the care which is taken to allow no part of the raw produce, out of which it is formed, to be absolutely wasted. An attention to this circumstance sometimes causes the union of two trades in one factory, which otherwise would naturally have been separated. An enumeration of the arts to which the horns of cattle are applicable, furnishes a striking instance of this kind of economy. The tanner who has purchased the hide separates the horns, and sells them to the maker of combs and lanterns. The horn consists of two parts, an outward

horny case, and an inward conical shaped substance, somewhat intermediate between indurated hair and bone. The first process consists in separating these two parts, by means of a blow against a block of wood. The horny exterior is then cut into three portions by means of a frame saw.

1. The lowest of these, next to the root of the hair, after undergoing several processes, by which it is rendered flat, is made into combs.

2. The middle of the horn, after being flattened by heat, and its transparency improved by oil, is split into thin layers, and forms a substitute for glass in lanterns of the commonest kind.

3. The tip of the horn is used by the makers of knife handles, and of the tops of whips, and for other similar purposes.

4. The interior, or core, of the horn, is boiled down in water. A large quantity of fat rises to the surface; this is put aside, and sold to the makers of yellow soap.

5. The liquid itself is used as a kind of glue, and is purchased by the cloth dressers for stiffening.

6. The bony substance, which remains behind, is then sent to the mill, and, being ground down, is sold to the farmers for manure.

Besides these various purposes to which the different parts of the horn are applied, the clippings which arise in comb making are sold to the farmer for manure, at about one shilling a bushel. In the first year after they are spread over the soil, they have comparatively little effect, but during the next four or five their efficiency is considerable. The shavings which form the refuse of the lantern maker, are of a much thinner texture: a few of them are cut into various figures and painted, and used as toys; for being hygrometric, they crawl up when placed in the palm of a warm hand, But the greater part of these shavings are also sold for manure, which, from their extremely thin and divided form, produce its full effect upon the first crop.

Manufacture of Eyes for Dolls.

The person examined on this occasion was Mr. Ostler, a manufacturer of glass beads, and other toys of the same substance, from Birmingham. Several of the articles made by him were placed upon the table, for the inspection of the committee of the House of Commons, which held its meetings in one of the committee rooms.

"Question. Is there any thing else you have to state upon this subject?

"Answer. Gentlemen may consider the articles upon the table as extremely insignificant; but perhaps I may surprise them a little by mentioning the following fact. Eighteen years ago, on my first journey to London, a respectable looking man in the city, asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it derogatory to my new dignity as a manufacturer, to make doll's eyes. He took me into a room quite as wide,

and perhaps twice the length of this, and we had just room to walk between stacks, from the floor to the ceiling, of parts of dolls. He said, 'these are only the legs and arms; the trunks are below.' But I saw enough to convince me that he wanted a great many eyes; and as the article appeared quite in my line of business, I said I would take an order by way of experiment; and he showed me several specimens. I copied the order. He ordered various quantities, and of various sizes and qualities. On returning to the Tavistock hotel, I found that the order amounted to £500. I went into the country, and endeavoured to make them. I had some of the most ingenious glass toy-makers in the kingdom in my service; but when I showed the eyes to them, they shook their heads, and said they had often seen the article before, but could not make them. I engaged them by presents to use their best exertions; but after trying and wasting a great deal of time for three or four weeks, I was obliged to relinquish the attempt. Soon afterwards I engaged in another branch of business, (chandelier furniture,) and took no more notice of it. About eighteen months ago, I resumed the trinket trade, and then determined to think of the dolls' eyes, and about eight months since, I accidentally met with a poor fellow who had impoverished himself by drinking, and who was dying in a consumption in a state of great want. I showed him ten sovereigns, and he said he would instruct me in the process. He was in such a state that he could not bear the effluvia of his own lamp; but though I was very conversant with the manual part of the business, and it related to things I was daily in the habit of seeing, I felt I could do nothing by his description, (I mention this to show how difficult it is to convey, by description, the mode of working.) He took me into his garret, where the poor fellow had economized to such a degree that he had actually used the entrails and fat of poultry from Leadenhall market to save oil, (the price of the article having been latterly so much reduced by competition at home.) In an instant, before I had seen him make three, I felt competent to make a gross; and the difference between his mode and that of my own workmen was so trifling, that I felt the utmost astonishment.

"Quest. You can now make dolls' eyes?

"Ans. I can. As it was eighteen years ago that I received the order I have mentioned, and feeling doubtful of my own recollection, though very strong, and suspecting that it could [not] have been to the amount stated, I last night took the present reduced price of that article, (now less than half what it was then,) and calculating that every child in this country not using a doll till two years old, and throwing it aside at seven, and having a new one annually, I satisfied myself that the eyes alone would produce the circulation of a great many thousand pounds. I mention this merely to show the importance of trifles, and to assign one reason, amongst many, for my conviction, that nothing but personal communication can enable our manufactures to be transplanted."

Tanning.

The process of tanning will furnish us with a striking illustration of the power of machinery in accelerating certain processes in which natural operations have a principal effect. The object of this art is to combine a certain principle, called *tannin*, with every particle of the skin to be tanned. This, in the ordinary process, is accomplished by allowing the skins to soak in pits containing a solution of tanning matter; they remain in the pits six, twelve, or eighteen months; and in some instances (if the hides are very thick) they are exposed to the operation for two years, or even during a longer period. This length of time is apparently required in order to allow the tanning matter to penetrate into the interior of a thick hide. The improved process consists in placing the hides, with the solution of tan, in close vessels, and then exhausting the air. The consequences of this is to withdraw any air which might be contained in the pores of the hides, and to employ the pressure of the atmosphere to aid capillary attraction in forcing the tan into the interior of the skins. The effect of the additional force thus brought into action can be equal only to one atmosphere; but a further improvement has been made: the vessel containing the hides is, after exhaustion, filled up with a solution of tan; a small additional quantity is then injected with a forcing pump. By these means any degree of pressure may be given which the containing vessel is capable of supporting; and it has been found, that by employing such a method, the thickest hides may be tanned in six weeks or two months.

The same process of injection might be applied to impregnate timber with tar, or any other substance adapted to preserve it from decay; and if it were not too expensive, the deal floors of houses might be thus impregnated with alumine or other substances, which would render them much less liable to be accidentally set on fire. Some idea of the quantity of matter which can be injected into wood by great pressure may be formed from considering the fact stated by Mr. Scoresby respecting an accident which occurred to a boat of one of our whaling ships. The line of the harpoon being fastened to it, the whale in this instance dived directly down, and carried the boat along with him. On returning to the surface, the animal was killed, but the boat, instead of rising, was found suspended beneath the whale by the rope of the harpoon; and on drawing it up, every part of the wood was found to be so completely saturated with water as to sink to the bottom.

Durability of Watches.

The durability of common watches, when well made, is very considerable. One was produced, in "*going order*," before a committee of the House of Commons, to inquire into the watch trade, which was made in the year 1660; and there are many of ancient date in the possession of the Clock-makers' Company, which are actually kept going. The number of watches manufactured for home con-

sumption was, in the year 1798, about 50,000 annually. If this supply was for Great Britain only, it was consumed by about ten and a half millions of persons.

Process in the art of Needle Making.

To arrange 20,000 needles thrown promiscuously into a box, mixed and entangled with each other in every possible direction, in such a form that they shall be all parallel to each other, would at first sight appear a most tedious occupation; in fact, if each needle were to be separated individually, many hours would be consumed in the process. Yet this is an operation which must be performed many times in the manufacture of needles, and it is accomplished in a few minutes by a very simple *tool;* nothing more being requisite than a small flat tray of sheet iron, slightly concave at the bottom. The needles are placed in it, and shaken in a peculiar manner, by throwing them up a very little, and giving at the same time a slight longitudinal motion to the tray. The shape of the needles assists their arrangement, for if two needles cross each other, (unless, which is exceedingly improbable, they happened to be precisely balanced,) they will, when they fall to the bottom of the tray, tend to place themselves side by side, and the hollow form of the tray assists this disposition. As they have no projection in any part to impede this tendency, or to entangle each other, they are, by continual shaking, arranged lengthwise in three or four minutes. The direction of the shake is now changed, the needles are but little thrown up, but the tray is shaken endwise, the result of which is, that in a minute or two the needles which were previously arranged endwise, become heaped up in a wall, with their ends against the extremity of the tray. They are now removed by hundreds at a time, by raising them with a broad iron spatula, on which they are retained by the fore finger of the left hand. During the progress of the needles towards their finished state, this parallel arrangement must be repeated many times, and unless a cheap and expeditious method had been devised, the expense of manufacturing needles would have been considerably enhanced.

Another process in the art of making needles furnishes an example of one of the simplest contrivances which can come under the denomination of a *tool.* After the needles have been arranged in the manner just described, it is necessary to separate them into two parcels, in order that their points may all be in one direction. This is usually done by women and children. The needles are placed sideways in a heap on a table, in front of each operator, just as they are arranged in the process above described. From five to ten are rolled towards the person by the fore finger of the left hand; this separates them a very small space from each other, and each in its turn, is pushed lengthwise to the right or to the left, according as its eye is on the right or left hand. This is the usual process, and in it every needle passes individually under the finger of the operator. A

small alteration expedites the process considerably; the child puts on the fore finger of its right hand, a small cloth cap or finger-stall, and rolling out of the heap from six to twelve needles, he keeps them down by the finger of the left hand, whilst he presses the fore finger of the right hand gently against their ends: those which have the points towards the right hand stick into the finger-stall, and the child removing the finger of the left hand, slightly raises the needles sticking into the cloth, and then pushes them towards the left side. Those needles which had their eyes on the right hand do not stick into the finger cover, and are pushed into the heap on the right hand previously to the repetition of this process. By means of this simple contrivance each movement of the finger from one side to the other carries five or six needles to their proper heap; whereas, in the former method, frequently only one was moved, and rarely more than two or three were transported at one movement to their place.

Meteorological Observations for October, 1832.

Moon. Days.		Therm. Sun rise.	Therm. 2 P. M.	Barometer. Sun rise.	Barometer. 2 P. M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.				Inches.	
☽	1	61°	57°	29.70	29.65	57	W.	Moderate.	.40	Cloudy—rain—fly'g. cld's.
	2	60	46	.65	.65	46	W.	do.		Flying clouds.
	3	56	44	.65	.65	44	W.	Blustering.	.40	Foggy—clouds—rain in
	4	60	47	.65	.65	47	SW.	do.		[night.
	5	60	51	.65	.80	51	W.	Moderate.		Clear day.
	6	60	52	.80	.85	52	W.	do.		Foggy—clear.
	7	59	58	.85	.75	58	SE.	do.		Foggy—rain.
	8	58	53	.90	30.00	53	NW. SE.	do.		Cloudy day.
	9	60	58	30.10	.15	58	SE.	do.		Cl'dy; drizzle; rain in n't.
⊗	10	76	66	29.90	29.90	66	S.	do.		Rain—flying clouds.
	11	59	62	29.70	.70	62	SW.	Blustering		Cloudy; rain; flying cl'ds.
	12	64	49	30.00	30.00	49	W.	do.		Clear day.
	13	62	49	.00	.00	49	W.	Moderate.	.20	Cloudy—rain.
	14	58	45	.00	.10	45	W.	do.		Cloudy—clear.
	15	60	53	.30	.30	33	W.	do.		Light frost—clear.
	16	57	42	.30	.30	42	SW.	do.		Clear—white frost—clear.
☾	17	63	51	.14	.10	53	SW.	do.		Fog—clear.
	18	70	61	.00	.00	61	SW.	do.		Fog—clear.
	19	70	61	.05	.10	61	SE.	do.		Lightly cl'dy. flying cl'ds.
	20	72	62	29.90	29.90	62	S.	do.		Cloudy—clear.
	21	69	53	30.00	30.00	53	S.	do.		Clear day.
	22	69	51	30.00	29.90	51	NE.	Blustering.	.40	Rainy day.
	23	58	52	29.70	.70	52	W.	do.		Cloudy day.
	24	62	36	.90	.90	36	N. NW.	do.		Cloudy—flying clouds.
	25	54	34	.90	.90	34	NW.	do.		Cloudy—flying clouds.
	26	43	24	30.25	30.34	24	NW.	do.		Clear day.
	27	32	40	.30	.10	21	W. SW.	Moderate.		Cloudy—clear.
	28	42	47	.10	.20	40	NW. W.	do.		Cloudy—clear.
	29	52	31	.30	.30	27	N.	Blustering		Clear day.
	30	58	38	.30	.30	31	NW. W.	Moderate.		Hazy—sun red.
	31	56	38	.30	.30	38	W.	Calm.		Clear—hazy.
Mean		46.67	30.35	29.98	29.98	47.2			1.40	

Thermometer. Barometer.

Maximum height during the month, 76. on 10th. 30. 34 on 26th

Minimum do. . . 28. on 29th. 29.65 on 1st, 2nd, 3d, 4th.

Mean do. . . 53.01 29.98

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